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The Farmer's Digest

Volume 9 December, 1945 Number 8

Dairy Cattle Development in the Future

Condensed from Holstein-Friesian World

R. R. Graves

U. S. Department of Agriculture

DAIRYMEN are aware of the difficulty of breeding uniformly good producing cows. Most any dairyman will tell you that if he could have a herd of cows as good as a few of his top cows, he would be sitting on top of the world. If he is a market milk producer and buys his replacements his herd is only as good as the cows he is able to buy and those who buy replacements admit that they are pretty spotty, so far as producing ability is concerned. I know farmers who are in the business of buying heifer calves from market milk dairymen to raise and sell back to the dairymen when they reach milking age. Many of the dairymen who buy their replacements give little thought to the breeding of the bulls they use, so that there is no reason to believe that the calves sired by their bulls, will be an improvement over their dams.

Several years ago the Bureau of Dairy industry made an extensive survey of the progress made by herds that had been testing over a period of years. The results were published in the 1936 Yearbook of Agriculture. These herds were no doubt owned by the more progressive and forward-thinking dairy farmers and breeders. Yet the results of the survey showed that for every sire used in these herds that brought about an improvement in producing ability there was also a sire used that brought about a decline in producing ability. Thus it is doubtful if even these more progressive farmers had, on the average, made any progress in creating a better germ plasm for level of production in their herds, during the period covered by the survey. The need is great for a practical method, or methods, of breeding that will get dependable results, not a few outstanding cows, but uniformly good cows.

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Most of us can recall many theories or methods of breeding that have been advanced as being certain to get fine results. There have been the advocates of line-breeding, of in-breeding, of out-breeding, of nicking, of hot blood, of cold blood, of prepotent sires, of proved sires, of the bull index, of great breeding cow families, of the high record dam, of dams with life-time records and so on. And now we are hearing a great deal of some new approaches, particularly of artificial breeding, cross-breeding for hybrid vigor, building new breeds, selective registration, and strains that are pure or homozygous for high levels of production. What of the future? What promise do these new approaches hold for the improvement of our dairy cattle?

Artificial breeding is being practiced within herds as a means of extending the service of a valuable sire; to make it possible to use crippled sires that cannot be used in normal matings; to prevent the spread of certain diseases, such as granular vaginitis and trichomoniasis, and to avoid the risk of introducing disease when animals outside the home herd are bred. When the problem of controlling the temperature of semen for long distance shipments is solved, it will be used quite extensively for the introduction of blood lines into herds in States and countries that are far distant from the sire. Artificial inseminaton is a method of mating to obtain pregnancy. It does not influence the germ plasm of the individual resulting from the pregnancy. The method of mating would make no difference in the germ plasm of a group of calves by a given sire, a part of which were the result of pregnancies resulting from natural matings and a part the result of pregnancies secured by artificial insemination. Its advantage is that it permits a given sire to get a far greater number of calves, particularly in artificial breeding associations, than he would get by natural service. Thus it makes possible a wider spread of the germ plasm possessed by the sires in service in these associations. It is to the artificial breeding associations and its possible effect on dairy cattle improvement that this discussion is directed.

The artificial breeding association is a co-operative, in which the herd owner agrees to have all or a part of his cows bred artificially to bulls owned by the association. He pays a stated fee for the service of each cow and usually an additional fee that goes into a fund that is used for the purchase of bulls. The association owns, houses and feeds the bulls used, secures the semen and prepares it for distribution to employees

who are called inseminators, and who go to the member herds on call, to inseminate cows that are in oestrum. Originally the inseminators were veterinarians but due to the demands of the war on the veterinarians, laymen are now trained and used as inseminators.

The advantage of the artificial breeding association to the herd owner is that he has the service of better bred bulls than he would buy; that he does not need to own a bull and that he is freed of the labor of feeding and caring for a bull. From a dairy cattle improvement standpoint the artificial breeding association was advocated as a move of the first importance because by this means one proved sire could service hundreds of cows in a year. When the movement started, associations attempted to have only proved sires in service, but due to the difficulty of securing adequately proved sires many associations now have less than one proved sire to each young unproved sire in service. In fact, one report says that less than 25 percent of the bulls used in artificial insemination work can be classed as proved. The associations are making an effort to choose the young sires they use from families or lines of breeding that offer a good probability that the young sires will possess a superior germ plasm.

The movement has now been underway five years in the United States. The Bureau of Dairy Industry has surveyed the progress of these associations each year. The number of associations, members and cows signed for service each year follows:

Year*	Associations	Members	Cows signed for service
1939	6	646	7,539
1940	27	2,971	23,977
1941	37	5,997	70,751
1942	73	12,118	112,788
1943	99	23,488	182,524
1944	96	28,627	218,070

*Data collected by Division of Dairy Herd Improvement Investigations, Bureau of Dairy Industry, as of January 1, for each of the years given.

While the work has expanded rapidly there are still less than one percent of the dairy cows in the United States being serviced by artificial insemination. The associations will have to grow to much greater proportions before they have a marked effect on the improvement of our dairy cattle.

C. T. Conklin in an analysis of the artificial breeding association work, in the February 1944 issue of the Ayrshire Digest, says. "— it seems as though artificial breeding cannot become an important factor in a nation-wide dairy cattle breeding program until it has many, many times the present enrollment. It would also seem as

though it cannot advance more rapidly than the herds of the purebred breeders who are responsible for furnishing the necessary sires."

The last sentence in the above quotation from Conklin, applies to most any method of dairy cattle improvement that may be undertaken. Another method for the improvement of the purebred breeders' herds that appears to be quite in vogue by the Breed Associations at present, is that of selective registration. The American Jersey Cattle Club put selective registration for bulls into effect on January 1, 1942, and I understand that some of the other associations are considering such a move. The objective of the Jersey Cattle Club in adopting selective registration for Jersey bulls is summarized in the following quotation from one of their publications:

"Although both parents contribute to the calf's inheritance of ability to produce profitably, it is axiomatic that a good bull is half of the herd—a poor bull is all of the herd. Selective registration, therefore, aims gradually to eliminate from the Jersey breed all bulls of poor production pedigree by barring them from the official Herd Register."

The requirements for eligibility were:

1. If his sire is a "proved sire" whose daughters, tested in DHIA and reported to the U. S. Bureau of Dairying, averaged 400 pounds butterfat in 305 days (M. E.) the bull calf may be registered; or

2. If his sire is a "tested sire" whose daughters under official production test, authenticated by the A. J. C. C., averaged 500 pounds butterfat on a 365-day basis (M. E.), the bull may be registered; or

3. If his dam has a record of 400 pounds of butterfat (305 days, M. E.), in DHIA or in the Herd Improvement Registry or the Register of Merit, or in the Canadian Record of Performance, he may be registered; or

4. If his sire is a "Star Bull," so identified by the special certificate awarded by the A. J. C. C., the bull may be registered.

It seems unfortunate that in taking such a step the American Jersey Cattle Club did not go far enough to insure in some degree the genetic purity of these selectively registered bulls for some level of production. After recognizing in the introductory sentence that both parents contribute to the offspring's inheritance for producing ability, they require a measure of merit from only one parent for selective registration. It has long been recognized by students of dairy cattle breeding that a cow's record by itself, is a phenotypic expression of her he-

reditary make-up for production rather than genotypic, and as such is not a very reliable guide to what she may transmit, yet under the A. J. C. C. plan it is a measure on which a bull may be accepted for selective registration. A bull calf may be registered if his sire is classified as a "Star Bull." There are several requirements which a sire may meet in order to be classified as a "Star Bull." Most of them have some production requirements for sire and dam but it is possible for a sire to be starred on the basis of the type classification of his sire and dam alone. All in all it does not appear that the regulations of the Jersey Club for the selective registration of bulls will result in an increased probability that the bulls so registered will possess a superior germ plasma for higher levels of production.

The step in this direction taken by the Ayrshire Association seems to me to be more sound and more likely to produce desirable results. On the back of each bull's registration certificate they print a pedigree of several generations giving for each ancestor shown the complete available facts concerning production records. We have long known that in order to gauge any animal's inheritance for production level, we must have all the facts, the data on the poor producers is just as essential as the data on the good producers. Nothing can lead one farther astray or can contribute more to the incorrect gauging of the inheritance possessed by an animal, than the suppression of the facts concerning any low producers that appear in the immediate ancestry and collateral lines.

Secretary Norton in his recent report to the members of the Holstein-Friesian Association, points to the great progress made in raising the production level of Holstein cattle in the Friesian Province of the Netherlands and he attributes this improvement to their system of selective registration. In 1931 the writer visited the Province of Friesland. I find in an article that I wrote, written on my observations of cattle breeding practices in Denmark and Holland, the following paragraph concerning "preferred sires" in Friesland.

"In Friesland a committee investigates the transmitting ability each year of Friesian sires. A sort of pre-investigation is made of bulls 4 years old. This examination may show the committee whether it is worth while to make further examination in later years. The real study is made of older sires having daughters in milk. The sons are examined for appearance and uniformity and the daughters for their producing ability and appearance. Each

year a few "preferred sires" are selected. In the year 1929-1930, 24 sires were examined and only 3 were pronounced "Preferential." Descriptions of these sires and their get, with information as to their producing ability is published. Particular emphasis is put on the percentage of butterfat in the milk of the daughters. It is felt that the percentage of fat is not subject to changes in environmental conditions as much as is the milk yield. Along with the description of the sire and his get is published a chart showing the distribution of the butterfat percentages of his daughters and their dams. This distribution chart is so arranged that one who is familiar with its arrangement can secure very quickly an indication as to the trend in percentage of butterfat of the daughters as compared to the dams. I was told that the sons of these "preferred sires" whose daughters showed a marked increase in the percentage of fat were in great demand."

"Any breeder can ask for the committee to classify his sire. The committee can, however, pass on bulls without being asked. It was my understanding that 150 offspring were required for the committee to pass on. The committee's findings were published in the weekly agricultural paper. The committee does its work during the winter months."

It appears that the Dutch committees were really picking out the sires that were showing up the best as transmitters of production, particularly those that were transmitting high percentages of butterfat, and also the desired type. Publicity was given to these successful breeding sires with the result that their sons were in demand as herd bulls.

I believe that selective registration in our registered herds might lead to rapid improvement if it were based on the number of generations of really meritoriously proved sire matings. More will be said about this under breeding pureline herds.

The use of the good proved sire is the surest method of breeding that we have tried for the production of uniformly high producing animals. The results of our experimental work indicate that if we are correct in gauging the inheritance of a sire (and we believe we can usually correctly gauge a sire's inheritance for level of production if we have available for study the data on his unselected daughters and if the daughters and their dams had the same opportunity to produce up to their respective capacities, we can expect good results from such a sire's service regardless of his relationship to the females to which he is mated or to the sires which preceded him in service. If the

sire possesses a superior germ plasm for level of production, the question of nicking, as commonly used, does not enter into the result.

It is an easy matter however, to misjudge the inheritance possessed by a sire. All data bearing on the matter must be carefully weighed and studied. The matter does not lend itself to simplification. It cannot be boiled down to a single figure such as a bull index, and be safely used as a basis for selection, particularly for the breeder who is attempting to breed a pure line that will produce seed stock for the improvement of other herds. If he makes a mistake and uses a poor sire that introduces into the germ plasm of his herd the factors that may be responsible for low levels of production, it may take several generations of breeding to eliminate completely these low producing factors. The dairy farmer breeding a herd only for profitable production will be primarily interested in maintaining a herd with high average producing ability. He will not be particularly interested in the purity of the germ plasm of his herd for the factors determining high levels of production. If he uses one poor bull he can cull out the poorer producing daughters, and if his next sire is a good one, the production level of his herd will return to normal. When good sires follow a poor sire, the production level will return to normal much more quickly (fewer generations), than will the purity of the germ plasm of the herd.

It was not uncommon for some uninformed people to imply that all herds should use proved sires, not realizing that there would not be a sufficient number of really good proved sires to go around. This has been shown by the inability of the artificial breeders' associations to obtain more than one quarter of the proved sires needed for their work, which to date covers a limited field.

Pureline Herds the Answer to Rapid Improvement of our Dairy Cattle. For a number of years we have carried on breeding experiments at the National Research Center at Beltsville, Maryland, and at several field stations in different States, to determine if it is possible to breed dairy cattle that will approach purity in their germ plasm for the hereditary factors determining high levels of production, by using, for generation after generation only sires that have been proved good. With cattle, such a program moves slowly because of their slow rate of reproduction and the time required to reach breeding age. If a mistake is made in gauging the inheritance possessed by a sire, it may take several generations to

eradicate the undesirable factors he introduces into the germ plasm of the herd. Then during wartimes there is the problem of maintaining the uniform environmental conditions that are essential to insure each generation of animals having an opportunity for the full expression of their hereditary capacity for production.

How many generations of proved sire matings will it take to produce lines that will approach purity or homozygosity for high levels of production? It is impossible to say. The number of generations required would be dependent on the degree of heterozygosity in the animals comprising the foundation generation; the number of allelomorphic factors controling level of production, which we do not know; the extent of linkage; the relative degree of fertility and vigor of heterozygous and homozygous individuals, and so on. Progress is most rapid in early generations. Probably absolute purity would never be attained but if our theory is true that the good proved sire is homozygous for the factors controlling production, and if no errors are made in gauging his inheritance, then in 8 or 10 generations a fairly high degree of homozygosity would be secured.

The results of our experiments are promising enough that we believe lines of a fairly high degree of purity for higher levels of production can be attained if sufficient care is given to see that the proved sires selected and used, actually possess a superior inheritance.

The following data show the results of five generations of proved sire mating at the Huntley (Montana) Field Station, as measured by the average butterfat records of each generation of cows, calculated to a mature basis. Most of the cows made their records as 2-year-olds. All were milked three times a day and all sound cows were kept in the herd until they had completed a lactation record —with very few exceptions. The cows were either kept in a stanchion barn or were run loose in a pen barn. Aside from the fact that they were milked three times a day the care given these cows was not superior to that on any well-managed dairy farm. The five generations of proved sire matings include the daughters of 10 different proved sires. The weighted averages are as follows:

Foundation Cows:
73 records.....587 lbs. butterfat
First Generation:
73 records.....658 lbs. butterfat
Second Generation:
67 records.....615 lbs. butterfat
Third Generation:
54 records.....615 lbs. butterfat

Fourth Generation:
36 records.....622 lbs. butterfat
Fifth Generation:
19 records.....638 lbs. butterfat

Of the 10 sires used one did not measure up to the predictions based on the data on which he was proved. If we omit his progeny, and their ancestral dams and filial descendants from the calculations, we have the following weighted calculations:

Foundation Cows
38 records.....592 lbs. butterfat
First Generation:
39 records.....651 lbs. butterfat
Second Generation:
33 records.....613 lbs. butterfat
Third Generation:
22 records.....620 lbs. butterfat
Fourth Generation:
12 records.....724 lbs. butterfat

The proved sires used in the station herd have not all had transmitting ability for the same level of production as was to be expected. That is, the average yields of the daughters of some sires have been higher than the average of others. With the exception of the get of the one inferior sire, the production has been quite uniformly good and fairly high, considering the prevailing environmental conditions under which the cows were tested, and the fact that culling of low producing females was not practiced to assist in maintaining a high level. Environmental conditions will have to be made more favorable before much higher hereditary capacities can be expressed in this herd. No matter how high a level of production a herd may possess an inheritance for, the actual production will only be as good as the size of the animals and the environmental conditions under which they are kept, will permit. If a herd possesses an inheritance for an average level of production of 300 pounds butterfat and the environmental conditions under which they are maintained are such that cows can easily make 450 pounds butterfat, the average production of that herd will remain at the 300 pounds butterfat level but if a herd has an inheritance for an average level of production for 700 pounds butterfat and they are kept under the 450 pounds butterfat environment, their average production will level off at about 450 pounds butterfat.

Once lines or strains are secured that approach purity in their inheritance for high levels of production, the problem of improving the mass of dairy cattle will be relatively simple. Young bulls from these pure line strains can be used and depended upon to transmit the hereditary factors for high level of production. They may be used in individual herds,

in bull associations or in artificial breeding associations. Herds will be improved without culling, excepting for the blemished, diseased, or abnormal individuals; improvement would proceed, even though production records were not kept on individual animals. As an illustration I cite the results obtained from the loan of young bulls born in the Huntley Station herd to cooperators for the purpose of proving the bulls' transmitting ability for level of production.

There are 15 of these co-operating herds that have used three or more station-bred bulls, and each bull now has three or more daughters that have completed a lactation record. These bulls are the product of one to five generations of proved sire matings but are put into use in the co-operator's herd when old enough for service. When the data from these 15 herds are brought together in one summary it is shown that there were 265 foundation cows whose best records averaged 411 pounds butterfat; 265 first generation daughters carrying one cross of station-bred bulls, whose best records average 461 pounds butterfat; 171 second generation daughters carrying two crosses of station-bred bulls, whose best records averaged 486 pounds; 67 third generation daughters carrying three crosses of station-bred bulls, whose best records average 541 pounds, and there are 26 fourth generation daughters carrying four crosses of station-bred bulls whose best records average 559 pounds butterfat.

We are not of the opinion that the Huntley Station herd has reached the pureline status but we do believe that it has made a good start in that direction.

If the breed associations really want selective registration we believe they can accomplish most by establishing a system that will give recognition to those animals that are the progeny of proved sire matings—adding to the recognition, in some such manner as the Jersey Cattle Club has used for one star bulls, two star bulls, three and four star bulls, but in this case, adding a star for each additional proved sire generation. If the bull to be registered is by a sire that has been proved to be good, and if the sire of his dam is a good proved sire—he would be the product of two generations of proved sire matings and would be entitled to two stars. But there must be no question about the sires being proved to possess a superior germ plasm. Such a system would, I believe, have positive beneficial results in the improvement of our dairy cattle.

Another New Breed of Hogs

Condensed from Capper's Farmer

George A. Montgomery

CHALK up one more score for Minnesota! Dr. L. M. Winters, animal breeder at the state's experiment station, is out with his second new breed of hogs. It is based on a Yorkshire-Poland China crossbred foundation. Winters has combined the prolificacy, milking ability and outstanding carcass quality of the Yorks with the factors for rapid growth and economical gains established in the inbred Poland lines he has developed.

The new breed, Minnesota No. 2, was announced just 9 years after initiation of a Minnesota program of swine improvement by combination of the best qualities of two breeds in a single strain superior in economic value to either of the parent breeds. First new hog developed by the technique Winters employs was Minnesota No. 1. In it blood of Landrace, Denmark's great meat-type hog, was fused with that of Tamworth, a superb bacon breed, sows of which have inherited ability to produce large litters and nurse them well.

Landrace, Yorkshire and Tamworth are breeds that show greater freedom from lardiness than the breeds now widely grown. Winters is convinced that, except under extraordinary conditions, such as those created by the present war, lard never again will be able to compete on a price basis with cheap vegetable fats. Therefore, his new breeds carry large proportions of high-priced lean meat and low percentages of lard, which again may sell at a figure below the live weight of swine to depress prices of all hogs marketed in this country.

Hog types patterned to order are something new in the livestock world. The older breeds were developed by process of evolution over a long period. The process was not aimless, but its direction has been changed numerous times by breed fads. Those men who have been growing hogs 30 years or more have seen type go from lardy cob-rollers to long-legged slim-jims, and turn back again to a conformation not so radical as either. Latest change came when commercial producers rebelled against the type set up by breeders and show-ring judges and began to buy boars and gilts,

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not for their pedigrees but for ability to turn feed into pork at a profit.

Winters starts with a certain type of hog in mind. To get it, he uses the methods employed by plant breeders to develop hybrid corn, disease - resistant small grains, better fruits and vegetables. He selects for a foundation the best individuals available in breeds that possess in highest degree the traits he seeks to fix in a new breed. The parent strains are crossed. He puts the progeny thru performance tests and, for continuing the line, selects individuals from litters that most nearly meet the ideal toward which he is striving.

In the No. 2's his goal was large litters, high livability, fast economical gains, a carcass that cut out good hams, loins and bacon with a minimum of excess lard, a dark-colored animal that would not sunburn as white-skinned hogs do.

A Yorkshire boar was crossed on several inbred Poland sows in the fall of 1941. Best of the crossbred boars then were mated to the better crossbred gilts. Gilts from this mating picked in performance tests for breeding purposes, were divided into 2 lots, one of which was mated to boars of the same breeding as themselves. The other lot was backcrossed to a Poland boar. Progeny of these 2 matings, one of which was one fourth and the other one half Yorkshire, then were crossed to produce a bloodline that is 62½ per cent Poland, 37½ per cent Yorkshire. The fourth generation of No. 2 pigs were grown out last summer at the Crookston substation in northwestern Minnesota. The type already is well fixed. The breed possesses great body depth, is big-hammed and long-loined. Bacon is of uniform thickness, well-streaked with lean. Animals will have the Yorkshire's erect ears and slightly dished face and the Poland's black skin. There will be splotches of white hair to give a coat pattern somewhat resembling that of Spotted Polands. Some litters still have a number of white pigs, since white is dominant over black, but Winters points out that a dominant characteristic is easy to eliminate; a recessive difficult.

Experience gained while establishing uniformity of type and color in the No. 1's will make it possible to arrive at the final form of the new breed within 5 to 7 years after the first litter of Yorkshire-Poland pigs were farrowed, he says. That will not mean, however, that continued production testing cannot be used to further improve the strain.

The Minnesota No. 1's, now in their ninth year, have found

ready acceptance among swine producers. The first ones put out were boars not needed in the breeding program. They went to commercial hog men, who crossed them on sows of other breeds. Almost unanimously buyers reported the pigs sired were the growthiest they ever produced. When gilts were available they were snapped up, and purebred herds have been established in Minnesota, Iowa, South Dakota, Missouri, Illinois, Indiana and Ohio. Royal W. Jackson, who has started a herd of No. 1's in Adams county, Illinois, weighed up his first litter when the 8 pigs were 110 days old. They averaged 148 pounds, and had gained 1.92 pounds a pig daily from weaning. John N. Cummings, animal husbandman, and Don Dailey, superintendent of Minnesota's North Central Experiment Station at Grand Rapids, weighed up gilts from their earliest 1945 litter and found they had gained from 1.62 to 1.90 pounds a head daily from weaning to 133 days old. Lightest weighed 163 pounds; heaviest 178. Most No. 1 test gilts reach 200 pounds at about 155 days at the Grand Rapids station. The Minnesota No. 2's do not make as rapid gains early as No. 1's but they are fast finishers and in 1944 caught up with No. 1's at 168 days.

From the 52 litters of No. 1's farrowed at the Grand Rapids station last spring, 501 live pigs were produced. Only 6 litters contained less than 7 live pigs. Most promising half of the litters was put on test to be used for selection of breeding stock. The 26 sows and gilts that mothered these litters farrowed an average of 11 live pigs a litter and raised an average of 9.15. The Minnesota No. 2's in 1945 farrowed 2 pigs a litter more than inbred Polands, which have been selected rigorously to develop and retain prolificacy.

Only a few No. 2 boars have been put out for test with farm herds. The reputation established by the No. 1's has given hog men confidence in anything Winters develops, and there already is application for No. 2 breeding stock when it becomes available.

Most important thing brought out by the Minnesota work is not the 2 breeds originated but the method of devolopment, Winters insists. It can be used not only for originating other new strains but for improvement of existing breeds. Winters himself is working to improve Polands. He has eliminated undesirable qualities and fixed desirable ones by inbreeding. Record of performance work is used in this project, as in the work with new breeds, to determine which individuals are best suited to continue

his lines. Intercrossing of the lines within the one breed gives a step-up in efficiency, tho it is not so great as when 2 breeds are crossed. The greater genetic diversity obtained in crossing 2 breeds gives No. 1 and No. 2 pigs that extra something known as hybrid vigor in addition to the superior traits carried over from the parent breeds.

The next phase of the work by Doctor Winters will be to make the new blood available to hog men of Minnesota and other states. He is not ready to say whether he may some day put the 2 new strains together to produce still another breed based on an even wider foundation, but he believes someone, using the same methods, may well do so.

Creating breeds to meet new conditions is rare in the livestock world. It has been done in a few other instances such as development of Santa Gertrudis cattle to meet Gulf Coast conditions and creation of Columbia and other new breeds of sheep to give range men flocks better fitted to their needs. Development of new crops, however, is being carried on at nearly every experiment station. Every leading winter wheat except Turkey is the product of the crop breeder, as are all the leading spring wheats. So are most of the oat varieties and a high percentage of the barleys. The same could be said of grain and forage sorghums, corn, and many other crops. Without these new varieties food production would be much more costly, yields far lower. Knowledge of plant genetics has made possible the big strides with crops, and, in the next few decades, it may well be that knowledge in the field of animal genetics will be applied, as Winters is using it, to remake farm animals to a more useful pattern.

Foaming Beans

Condensed from Farm Journal

A FARM product with new farm uses saved the aircraft carrier Enterprise when a Jap bomb hit the ship in the Marshall Islands raid. The flight and hangar decks flamed furiously with burning high test gasoline. Soybeans put out the fires in just one minute.

Soybeans, that is, after they had gone through a complicated chemical process, in which their protein content had been transformed into a flaming liquid formed into a foaming liquid. The navy calls the liquid "bean soup"; the manufacturer calls it aer-o-foam.

One gallon of the compound, mixed with 9.4 gallons of water, makes 125 to 140 gallons of tough, clinging foam which will suffocate any flame. It snuffs out the oxygen supply.

Now that the war is over, aer-o-foam may extinguish farm fires as promptly as it saved battle wagons and American lives. Because it multiplies the fire fighting capacity of a gallon of water, it makes even a shallow well a good farm fire extinguisher.

Only a special nozzle will squirt aer-o-foam—one that has a connection for a water hose, and a siphon to suck the liquid out of the can. To give the foam a peace time farm career, the manufacturers have just designed a nozzle that fits ordinary garden hose, and that works well with water pressures as low as 30 pounds per square inch.

The foam may find an even bigger farm job. It may fight bugs as well as fire. Tests as a carrier for insecticides and fungicides are underway. First results of trials with fog nozzles show the idea is entirely practical, although new nozzles probably will have to be designed to make the spray efficient for all crops.

Nothing short of a hurricane will blow aer-o-foam off of any surface it strikes. That's why it may make a good spray carrier, and an economical one, as well, despite its cost. Because it takes hold wherever it hits, it should do away with the waste of drench sprays. That also should mean an end to the danger of poisoning soil with a saturation of spray dope in orchards and groves where trees must now be drenched.

With the end of the war, civilians soon will be able to buy aer-o-foam, and the nozzles for use with it, through commercial fire fighting equipment supply houses.

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Big Fish in Your Pond

Condensed from Missouri Ruralist

THERE is one crop that is a pleasure to harvest — fish from farm ponds. And Missouri farmers are planning to do more fishing in the less crowded days of peacetime. Already they are building thousands of farm ponds, and many of these are being planned as recreation spots for the family.

So it comes as welcome news that the experts are learning to grow bigger fish. Thru use of fertilizer and other good-management practices, you can grow fish plenty big enough to make a good meal in little more than a year.

Fish grown in a pond, where all conditions can be controlled, will make much more rapid growth than the same types of fish living in streams.

If you wish to consider growing a crop of fish from a business viewpoint, instead of for pure recreation, there are possibilities for good profits in raising bait minnows—for other fishermen.

Basis for these new ideas on growing fish are experiments being conducted by Aden Bauman, of the fisheries section of the Missouri Conservation Commission. Mr. Bauman is working with about 30 ponds near Columbia in a study to find out how to grow big fish in a hurry, and how to have a pond that will provide good fishing year after year. He hasn't found all the answers yet, but some of his results are startling.

You probably will take down the "No Fishing" signs after studying Mr. Bauman's records. For it is obvious that most ponds are not fished nearly enough. Each year there is a good crop of fish produced if conditions are right—usually more than can be caught with a pole and line.

To grow big fish in our ponds we must not only have fertile water but we must have a balance in the kinds of fish present. Suppose you plan to have only big, large-mouth bass in your pond. In such a case the large bass eat the smaller bass, which in turn eat the smaller fingerling bass that feed on the tiny fry which live on plankton. Thus, if fry and fingerlings were always present in sufficient numbers, the chain would be complete. However, there are times during the year when there are no freshly hatched fry, and very few fingerlings.

Reprinted by permission from the Missouri Ruralist, Topeka, Kansas, Sept. 22, 1945

Only such food as insect larvae is then present and the big bass do not get enough to eat.

Suppose we add crappie to the pond. This provides more food for the larger fish, but crappie eat about the same food as the same size bass. Only the tiny fry can utilize plankton.

The main foods for fish in a pond include insect larvae, worms in the mud, ooze on the bottom, plants, plankton, and outside matter that falls on the surface.

What is needed are fish that will utilize these foods, so they in turn can serve as food for the larger bass and crappie. Object of the experiments with the 30 odd ponds is to find such a forage fish. Probably the ideal combination will include the use of some type of minnow.

Use of fertilizer and lime in a pond does more than make the fish grow like mad. For one thing —and it's important—ponds can be made clear. Most of us know of ponds that remain cloudy thruout most of the year for no apparent reason. The water may run off bluegrass sod, yet the pond will appear muddy.

Mr. Bauman has found that it is impossible to muddy a pond that is in proper balance. To demonstrate he walked out into the slime bottom of a small pond being used for bait growing on the farm of Andy Bass, near Columbia. The water, of course, became cloudy. But in 5 minutes it again was settled and clear.

Water that is either acid or alkaline tends to be clear. You can add either limestone or fertilizer of an acid nature and the pond will clear up. Another idea is to add organic matter. Cut the grass and weeds around the pond and throw them in the water.

Use of fertilizer also destroys unwanted underwater plant growth. Altho plants around the water's edge are highly desired, the various kinds of water moss and plants that clog up ponds make fishing impossible. Liberal applications of fertilizer will usually clear out the underwater growth.

Water teeming with plankton is not crystal-clear—but it's not muddy. There's a difference. If you can see the bottom of your pond there is not enough plankton to make fish grow rapidly.

With a special outfit Mr. Bauman collected water from a fertilized pond. A silk cloth filtered out the plankton, which in this case was dark-pea green in color when concentrated. The water with the plankton filtered out was crystal-clear.

In another pond the plankton was of a dark-brown color. Thus, a "fertile" pond has a very definite color to the water.

Old ideas are being exploded about fish ponds. For instance,

spawning-ground protection such as brush or wire netting in a pond is unnecessary. In a pond that is in good balance there will be enough of the small fry escape the larger fish to provide plenty of fishing. One adult bass, for instance, will easily spawn 10,000 young. That means a lot of future fishing.

And then there is the new viewpoint, supported by the Conservation Commission, that a wire screen is not needed in the spillway. That's hard to swallow by veteran fishermen. Tests have shown that if the water in the spillway is not more than 8 inches deep at any time no catchable fish will escape. Spillways, then, should be built so that the water will never be more than 8 inches deep.

Usually black bass are stocked at the rate of 100 to the acre, or 2½ bass to 1,000 square feet of water. About 1,500 bluegill to the acre are planted. Crappie and other fish are stocked in similar numbers. The original stock is not too important.

Just what you will want in your pond depends on personal taste. The large-mouth bass is the supreme pond fish for Missouri, and should be the ultimate goal. There's nothing like hooking 6 pounds of fighting fish on the end of a casting line or flyline! Crappie makes a fine fish for less skilled fishermen. They can be taken with flies and fancy bait or they will bite equally well on minnows and worms.

There isn't a farm family too busy to enjoy an occasional outing on the farm. And pond fishing supplies one of the finest sports in the world.

When Your Land Needs Phosphorus

Condensed from Successful Farming

F. C. Bauer

University of Illinois

ALL of us who have anything to do with cropping fields have been guilty of prodigal spending. We've used up a good portion of our phosphorus supplies. Most times we couldn't quite figure out what had hit our yields because we didn't realize we were spending so fast, but nevertheless, the "money" is gone.

A big tonnage of phosphorus has been taken from the soil without any going back. In an Illinois field experiment (in which corn has been grown every year since 1876 without soil treatment) the phosphorus content of the plow layer was reduced from 900 to 650 pounds an acre between the years 1904 and 1933. Following tests will, no doubt, show further loss. Summaries made of estimates by the state agricultural experiment stations reveal that the phosphorus balances for most states are well in the red.

These estimates show further that it would pay farmers over the country as a whole to use about four times as much phosphate as they used at the beginning of World War II, and about twice as much as they used in 1944. Some of the southern and eastern states now show favorable phosphorus balances, but in many of the other states there has been little, if any, putting back of the phosphorus taken out by crops, livestock, and erosion.

Phosphorus has often been referred to as the master key to a permanent agriculture. This reputation has been gained, not because phosphorus is the most important soil element or because phosphatic fertilizers will produce larger yield increases than fertilizers supplying other elements, but because phosphorus occupies a somewhat unusual position in plant, animal, and soil relationship.

Phosphorus is present in every living cell, and is closely related to the formation of new cells. In plants, phosphorus is especially important in keeping up root development and seed formation. It hastens maturity and promotes a vigorous growth.

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Healthy plants mean healthy animals. In animals, phosphorus is important in the development of bones and teeth. It is also closely related to growth, health, and the ability to breed. "Probably no dietary deficiency of livestock, particularly cattle, is so common the world over as a deficiency of phosphorus. A lack of this mineral in livestock rations is due primarily to a deficiency of phosphorus in the soils on which the plants used for feed were grown," says the USDA Yearbook for 1939.

The soil, then, is the chief source of phosphorus for both plants and animals. The points of interest are the rather small amounts present in the soil and the slowness with which they become usable. Many of the best soils contain less than 1,500 pounds of this nutrient element in the plow layer of an acre, and numerous other soils contain less than 500 pounds. Such small supplies mean that many soils cannot yield enough available (usable) phosphorus to meet the needs of the crops growing on them.

Soils low in phosphorus produce crops with stunted roots and tops. Under these conditions maturity is delayed, and the crop becomes more likely to suffer from insects and diseases. The final result is lowered quality and reduced yields. Generally, growing crop plants do not show the effects of phosphorus starvation as plainly as they do the effects resulting from nitrogen and potassium starvation.

There are situations, however, in which field crops show phosphorus hunger in a very striking manner. If the roots of the young plants become damaged by insects and are thereby rendered unable to absorb little if any phosphorus, the difficulty is quickly shown by the plant. If the crop is corn, the plants become stunted and many of the leaves turn purple. When the insect ceases feeding and new roots develop, the crop may make considerable recovery, but the setback usually lowers yields. This is frequently a serious problem on many Cornbelt farms, especially when corn follows legume crops that have been on the land one or more years.

Keeping the soil well supplied with available phosphorus will do much to offset the bad effects of the root damage. The phosphorus-supplying power of the soil may be increased in several ways:

Soils low in available phosphorus but otherwise fairly productive frequently show improvement in phosphorus-supplying power when the cropping system includes the regular growing of

deep-rooted legumes. The plants reach down to subsoil sources of phosphorus. The method should be regarded solely as a temporary solution of the problem.

Livestock farming, in general, does not reduce the available phosphorus in the soil so rapidly as does grain farming. Some phosphorus is removed by livestock and some is lost, but—with care—about 50 percent of the phosphorus in the feed crops can be returned to the soil. Many livestock farmers will find it profitable to supplement the manure they provide with phosphatic fertilizers.

Applying phosphatic fertilizers is the only sure method for maintaining a practical supply of usable phosphorus in the soil. There are several carriers differing in chemical form, behavior in the soil, and price, that may be used for this purpose. Some of these are:

Superphosphate, which contains phosphorus in a soluble form and ranging from 16 to 48 percent P_2O_5 (phosphoric acid) content. It is widely used over the country. It may change in the soil and be less easy to dissolve before the phosphorus is used by the plant. A grade common to most sections is that carrying 20 percent P_2O_5. This grade, or its equal, is usually applied for crops at or near planting time at rates ranging upward from 100 pounds an acre. Fall-seeded grains and the legume crops seeded in them react especially well to this carrier. Superphosphate is used extensively for top dressing pastures. In some sections where the soils tend to be neutral or alkaline, as in north central Iowa, alfalfa has responded remarkably well to top dressings of 20-percent superphosphate applied at the rate of 300 pounds an acre. This carrier has a wide field of usefulness.

In some sections, finely ground rock phosphate carrying 30 to 34 percent P_2O_5 is an efficient source of phosphorus. The phosphorus in this carrier is not water-soluble (capable of dissolving in water) but it becomes usable to crop plants by means of changes within the soil and the use of crops in the rotation that possess high feeding capacities for it. Because of the differences in chemical behavior and price, rock phosphate should be used somewhat differently than superphosphate. It is usually applied at intervals of 10 or more years at rates of 1,000 pounds or more an acre. Applied in this manner and in connection with cropping systems built around the regular use of legumes, rock phosphate has proved to be an effective source of phosphorus for the crops in rotation, and will fit well into a long-time soil improvement program.

During recent years some new carriers of phosphorus have appeared, some of which carry as much as 70 percent P_2O_5. These phosphates are in the experimental stage, but it is possible they may provide advantages not possessed by the more commonly used carriers.

Mixed fertilizers with various percentages of P_2O_5 are widely used in many sections, not only to supply available phosphorus, but other plant food elements as well. Where sufficient amounts of the proper grades are used, satisfactory results can usually be obtained. Most experiment stations can supply recommendations for grades and amounts.

The use of phosphatic fertilizers does not necessarily insure increased yields. Other factors may offset response. The use of subsoil phosphorus by deep-rooted legumes, soil differences, and the use of other treatment practices are among such factors. One of the most important of these is a lack of another nutrient element. For instance, if the nitrogen-supplying power of the soil is low, a phosphatic fertilizer is likely to have little effect, even tho the available phosphorus is also low.

A like relationship exists for soils low in available potassium. In a similar manner an uncorrected phosphorus shortage will handicap response to the use of fertilizers carrying other nutrient elements. Numerous experiment-station data illustrate these facts and emphasize the need for fertilizer programs that balance with soil requirements. This is one reason for the production and use of various grades of mixed fertilizers. If the proper grade is used in sufficient quantities, good results can be expected. Often, however, one or both of these things are neglected and the results are disappointing.

Altho many soils are low in phosphorus-supplying power and would benefit from the use of phosphatic fertilizer, it would be well for you to obtain as much background information as possible before starting a fertilizer program. Some experiment stations recommend small-scale trials as a guide to future practices. The experimental facts and recommendations that can be obtained from the state experiment stations should be studied. These studies should be supplemented with all the facts you can obtain about your own soil. The growing crops should be watched for the distress signals. Soil tests should be made to find out the nutrient elements missing and for information on the degree of shortage. Plant-tissue tests made at proper times during the growing season will indicate what elements the plants are not get-

ting in large enough amounts for good growth. With such information, plans can be made to get the best returns now, as well as long-time production. State experiment stations and extension services will always be glad to help you with your program.

Protecting Wood from Within

Condensed from Florida Grower

SCIENTISTS of the United States department of agriculture have developed a method by which farmers and other users of wood-lot trees can introduce chemicals into the sap stream of the wood to increase the length of service of fence posts, bean poles, garden stakes, and other utility poles.

The method is neither difficult nor expensive to use. The fresh-cut saplings with limbs and leaves attached are simply allowed to stand in a wooden tub or trough containing the right amount of chemical in solution for a period of about 6 hours or until they have taken up the required amount of chemical. Tops of the saplings are supported by leaning them against a tree, building, or other support.

Chemicals recommended include chromated zinc chloride, zinc chloride, and copper sulfate (bluestone), of which the chromated zinc chloride is the best. These chemicals can be obtained at seed stores and other sources where farmers ordinarily buy such supplies. The chromated zinc chloride is twice as expensive as zinc chloride or copper sulfate, but it protects the wood longer, and is also less corrosive to wire staples than copper sulfate.

One pound of either of the chemicals dissolved in a half gallon of water will treat one cubic foot of wood, or the equivalent of a sapling which measures about 4 inches at the base and is about 30 feet tall.

Best results are obtained when the saplings are treated immediately after cutting from the stumps. When it is not possible to treat them soon after cutting, or if the pitch oozes out of the soft woods, about 1 inch should be sawed from the cut end immediately before treating, to permit the chemical solution to enter the sap stream. The lower branches may be removed for convenience in handling, but a few upper branches left attached

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will hasten the treating process by facilitating sap movement.

Many kinds of both hard and soft-wood saplings or trees of a size easly handled can be treated by the sap-stream method. Pine trees are more effectively protected against damage by insects and decay than are many hardwoods.

The treatment is best applied during the spring and summer, particularly on bright sunny days, when the sap flows most rapidly. Hardwoods can be treated only from early spring to late summer. Pine trees can be treated any time except during freezing weather. Evergreens, treated in winter, require about a day to take up the necessary amount of solution.

The method of introducing chemicals into trees and poles through the sap-stream has been known to scientists for years, but until recently the method has not been practicable for use by farmers. The new technique is the result of ten years investigations, from 1930 to 1940, in North Carolina and South Carolina by the bureau of entomology and plant quarantine, in cooperation with the Appalachian Forest Experiment station, United States forest service. The investigations are continuing in the hope of improving the method and finding better chemicals for wood preservation.

The scientists warn that all of the recommended chemicals are poisonous and should be kept out of the reach of children, pets, and livestock. None of them should be stored in metal containers. Because copper sulfate is corrosive, it must not be used in metal tubs or troughs.

Growing Market Hogs Without Animal Protein

Condensed from The Berkshire News

B. A. Rockwell

Director of Agricultural Research, Hershey Industrial School Farms, Hershey, Penna.

Two hog feeding experiments recently concluded by the Research Department of the Hershey Estate's Farms have produced evidence that Brewers' Yeast supplemented with small amounts of steamed bone meal and limestone or a good commercial hog mineral and used as a substitute for animal tankage will give excellent results in growing market hogs. The incentive to carry on these experiments was brought about by the inability to secure sufficient tankage during 1943, due to wartime shortages, to feed a population of twelve hundred hogs.

The first feeding test was started in January, 1943, and extended over a period of two hundred and two days. Results obtained from the Brewers' Yeast Ration which contained no animal protein were so astounding that uncertainty arose and experimental error was under suspicion. Therefore, to relieve this question of doubt the feeding test was repeated in 1944 and extended over a period of one hundred fifty-seven days.

Procedure:

In order that growth factors due to breeding would be identical in each pen the pigs were assembled in the following manner:

1943—One pig from each of five different litters was placed in three separate pens (5 pigs to a pen). Thus each pig in Pen I had a littermate in Pen II and in Pen III.

1944—Two pigs from each of three litters were placed in three separate pens (6 pigs to a pen). For each pair of littermates in Pen I there was a pair of littermates in Pen II and III. Rations used in self-feeders:

PEN 1 — RATION I (12.4% PROTEIN)

300	lbs. grain shelled yellow corn
150	lbs. ground oats
50	lbs. flour middlings
35	lbs. ground alfalfa hay
60	lbs. proteast*
16	lbs. Sea Board mineral base
14	lbs. ground limestone
3	lbs. salt

*A mixture of Brewers' yeast, soy bean, barley and corn meals.

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PEN II — RATION II (16% PROTEIN)
(Check Ration)

100 lbs. ground barley
120 lbs. ground yellow corn
150 lbs. ground oats
90 lbs. ground wheat
40 lbs. soy bean meal
40 lbs. tankage
60 lbs. ground alfalfa hay
10 lbs. Sea Board mineral base
8 lbs. ground limestone
3 lbs. salt

PEN III—RATION III (12.5% PROTEIN)

225 lbs. ground shelled yellow corn
167 lbs. ground oats
200 lbs. ground wheat
67 lbs. pig Manamar
12 lbs. Sea Board mineral base
7 lbs. ground limestone
4 lbs. salt

Summary

1. Ration I was the "Big Surprise" of these feeding tests. With no animal protein and only 12% total protein it produced 100 pounds pork (live weight) for $10.23 as compared with $9.92 for the check ration.

2. Ration II, the check ration, which contained the greatest amount of animal protein and the largest content of total protein proved the most economical in growing market hogs. This was to be expected and when proteins (animal and vegetable) are available Ration II is ideal.

3. During periods of protein shortage and when price levels are comparable to those which existed between January 1, 1943, to May 1, 1944, market hogs can be grown at a profit with a ration containing only 12% total protein.

General Remarks

1. Consistent results. Even though the judge knew nothing of the feeding procedure, he rated Pens Nos. I, II, and III exactly the same in both experiments. These identical placings relieved any doubts of experimental error.

2. During periods of shortages of animal protein Brewers' Yeast fed to market hogs will release tankage for brood sow feeding.

3. No feeding experiments to test the merits of Brewers' Yeast for brood sows have been conducted.

4. Perhaps, since Brewers' Yeast is high in Vitamin B complexes, especially niacine, we may discover a combination of Brewers' Yeast and Animal Protein to be the ideal hog feed.

COMPILATION OF PROCEDURE AND RESULTS

	Pen I Ration I	Pen II Ration II	Pen III Ration III
Number of hogs	11	11	11
Average live weight at beginning of test	33.2 lbs.	34.3 lbs.	30.7 lbs.
Total live weight at end of test	2391 lbs.	2434 lbs.	2128 lbs.
Average live weight at end of test	217 lbs.	221 lbs.	193.4 lbs.
Average daily gain	1.286 lbs.	1.31 lbs.	1.145 lbs.
Total dressed weight	1959 lbs.	2012 lbs.	1928 lbs.
Per cent dressing loss	17.7 lbs.	16.8 lbs.	18.4 lbs.
Total pounds feed consumed	8344	8168	7943
Total feed costs	$207.35	$204.10	$212.08
Pounds of grain fed per pound of gain	4.12	3.96	4.53
Cost per 100 lbs. live weight gained	$10.23	$9.92	$11.78

The hogs were killed, dressed and weighed in a modern abattoir. The carcasses were carefully inspected and judged as to merit by an individual with long experience in the butchering profession. In no instance was the judge familiar with feeding procedure.

Rations were as follows:

	Pen I	Pen II (check)	Pen III
Condition of carcass	good	good	good
Firmness of flesh	(average) fair	excellent	good
Firmness of fat	(average) fair	excellent	good
Condition of bone	excellent	excellent	excellent
Final placing	*3	1	2

*Even though Pen I received the poorest rating, nevertheless the judge stated that the yeast fed hogs would grade as well as the majority of fat hogs sold to the Abattoir by farmers outside the Hershey Farms.

Modern Chemistry in Weed Control

Condensed from Pennsylvania Farmer

J. B. R. Dickey
Pennsylvania State College

RECENTLY some New York scientists, experimenting on the effect of hormone sprays in making apples hang on the tree longer, noticed that morning glory vines under the trees appeared to be dying. This led to further experiments with hormones on various weeds. Some plants were seriously damaged or eventually killed outright, while others were apparently unaffected. This opened up an interesting field of "selective killing" of weeds in sod, turf or crops, and the matter was given a sensational play by the public press long before the details were worked out.

The hormone in question, known as 2,4-dichlorophenoxyacetic acid, commonly abbreviated to 2,4-D, is one of the group of so-called "growth regulating" substances. There are several forms, and it is manufactured with various carriers in order to make it soluble or usable as a spray. This makes for various strengths, solubilities, etc., so that any standard or simple directions for dilution and use, as well as any definite conclusions as to effectiveness, are almost impossible at this time.

2,4-D does not burn the foilage as do herbicides based on salts, oils, acids, etc. Sometimes there is little apparent effect for several days. Gradually, however, with some plants abnormalities of

growth develop. Stems may thicken, curl and fail to flower. In some cases the plant turns an unnatural color and perhaps eventually dies root and branch. In other cases the foliage may be killed but the root quickly sends up new leaves and branches and goes on doing business.

The small grains and most of the grasses seem unaffected, but most cultivated plants, and probably corn, are seriously affected or killed; so that while the farmer may eventually learn to control such weeds as mustard in oats, the hoe and the cultivator will still be needed with intertilled crops and vegetables. While we may be able to rid lawns and pastures of some weeds with little damage to the grass, when materials and methods of application are fully understood, all the clovers seem to be adversely affected. We might get along without clover in a lawn, and it probably would come back from seed, but the clovers in most hay and pasture land are too important and valuable to be endangered. Garlic plants, individually sprayed, are reported to curl up and go into a decline; but garlic is a resourceful thing and only time will tell whether it does not stage a comeback.

Caretakers of lawns and golf courses will be interested in the fact that most of their particular pests such as dandelion and the plantains are pretty readily killed by 2,4-D. Bluegrass seems uninjured, but the bent grasses used on golf greens are seriously hurt. Crab grass seems resistant and all of the weeds will soon come back from seed, particularly unless a management system of fertilization and high cutting favorable to the grass is adopted.

Many of the old established chemical companies are experimenting with 2,4-D, but are not yet ready to put it on the market commercially until they know more about the most satisfactory form to use, when, how and how much to apply, and what can confidently be expected of it. Experimenters at state and national experiment stations are still noncommittal and rather reluctant to make positive statements and recommendations. If used in the present state of our knowledge all we can say is to use it according to the manufacturer's directions and hope for the best. To comply with the directions of one concern which is advertising widely would cost about $80 per acre for the material. This is too expensive for anything but spot treatment. It is felt, however, that when the proposition is thoroughly worked out and when unrestricted manufacture is possible costs will be reduced to a figure which will make it economical even on farm weeds.

Summer Shelter Makes Low Cost Winter Laying House

Condensed from Everybodys Poultry Magazine

C. E. Lee

For the past quarter of a century, the trend in poultry house construction has been toward the building of better insulated houses, often with artificial ventilation.

While our experiments, covering several years, published in Poultry Science (July, 1937, and September, 1939), demonstrated that the use of supplementary heat in an insulated laying house under the climatic conditions of Central New York State resulted in a lower annual egg production, a slightly lower feed consumption, and a serious and consistent lowering of the net flock income, the general conclusion from our work and that of other investigators has been that we should construct houses so that the natural heat of the birds will be conserved.

It has appeared necessary, in order to do this, to build laying houses which have thick walls and use some good type of insulation. Another necessary feature has appeared to be insulation of the ceiling. In fact, where cost had to be kept down to the lowest possible point, poultrymen have generally provided ceiling insulation of some type even though the walls could not be insulated.

By using well insulated walls and ceilings, a proper differential between inside and outside temperatures could be maintained in cold weather so that a well planned ventilation system would work very effectively. More and more metal ventilators have come into use.

The total cost of houses on some farms has gone as high as $6.00 per bird to our knowledge.

How Much Can a Hen Carry?

It seemed to us that before this trend went any further, we should find out definitely whether birds really did better in an insulated house than in one which was nearly at the other extreme. Poultrymen have, from time to time, secured quite good results from emergency houses made out of range shelters or hen shelters that have been partially closed in for the winter.

The value of a hen is small and her earning power is correspondingly limited. We must be careful, therefore, how much overhead expense we pile on the hen. Many people, particularly city people, who have considerable capital to invest, do not give sufficient consideration to this limited earning power of the hen and make a net

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profit impossible from the start by loading the hen down with extremely expensive housing and equipment.

In our experiment, we decided to compare eight pens of layers in a Connecticut laying house with the performance of a pen of birds out of the same lot, selected for typical maturity and size, placed in a Connecticut 24 by 24 foot hen shelter.

The birds were fed on a 22 per cent protein laying mash supplemented with pellets at noon and scratch grains at night.

The accompanying tables show the egg production for these July-hatched birds which were started on test in January, both in the shelter and in the Connectiuct laying house. In order to save space, summer production figures are not included, but as might be expected, the birds in the shelter did correspondingly just as well through the summer.

It will be noted that the birds in the laying shelter averaged, for this period of five months, over 80 per cent production, as compared with 77.33 per cent and 72.93 per cent for the two typical pens in the standard laying house.

It is also noteworthy that the birds in the laying shelter, in spite of this high production, consumed about 1 pound less mash per bird, practically the same amount of fleshing pellets (regulated accord-

SUMMARY — LAYING SHELTER VS. LAYING HOUSE

Red-Rock Cross Pullets (Hatched July, 1943)
(January to May, inclusive, 1944)

	Days	Total Eggs Per Bird	Ave. No. Eggs Per Bird	Per Cent Prod.	Feed Per Bird (lbs.) Mash	Pellets	Grain	Total Feed Per Bird	Total Feed Cost	Lbs. Feed Doz. Eggs	Feed Cost Doz. Eggs
LAYING SHELTER	152	121.72	24.34	80.10	21.88	11.57	19.18	52.58	$289.51	5.18	18.11c
HOUSE 1 — PEN 1	152	117.48	23.50	77.33	27.92	11.80	17.26	56.98	139.94	5.84	20.28c
HOUSE 1 — PEN 5	152	110.84	22.17	72.93	26.59	11.63	16.33	54.55	140.74	5.91	20.61c

ing to production), and only an average of about one-half pound more grain per bird for the period, so that their cost of feed per dozen eggs produced was less. Even the feed cost per bird was $1.83 in the shelter as compared to $1.93 per bird, respectively, in the two pens in the standard laying house.

Of course, one season doesn't settle anything, so we repeated this again with the Red-Rock cross pullets hatched in July, 1944, with results that were practically identical.

Strangely enough, we found that the hen shelter was not only the most comfortable house on the place in the summer, but also was very comfortable most of the time in the winter. Contrary to expectations, this house was not terribly cold in the winter. The hinged boards on the sides, and, of course, also on the rear of this shelter were closed down in the winter. They were far from airtight, but were reasonably so. Moreover, the nests were along the west wall on the side toward the prevailing wind, and these also helped to cut down the flow of cold air from that side.

Note that the front or south end of the house was completely covered with transparent, wire-base, glass substitute, except for the upper half of the entrance door which was left open for ventilation, and the triangular space in the peak which was permanently boarded.

After studying the conditions in this house, we came to the conclusion that there were two factors mainly responsible for the comfortable temperature inside the house.

First, of course, was the glass substitute. This presented a large area for penetration of the sun's rays. On bright winter days, a considerable amount of radiant heat was trapped in the house, and since glass substitute does not transmit heat by conduction to anything like the extent of ordinary glass, the trapped heat did not escape to the extent which would have been true at night, had ordinary window glass been used across this front area.

In the second place, the double pitch roof with tight boarding for a distance of some 3 feet or so below the peak, at each end, trapped a layer of air to the extent that there was a cushion or layer of "dead air" created.

This provided further insulation against the escape of heat, generated by the birds, through the roof.

The principle of trapping radiant heat has been given a great deal of attention by famous architects in recent years and a number of homes and other buildings have been constructed, particu-

larly in the Chicago area, having the entire south wall formed of two layers of glass with a sealed dead air space between. This side is also provided, as a rule, with drapes which can be slid over the glass at night to add further insulation against the escape of trapped heat from the sun.

The total annual fuel consumption in such homes is below anything which has been known previously.

A glance at the illustration of this same shelter in summer will indicate why, in spite of lack of insulating materials and any artificial ventilation system, this is the most comfortable house on the farm in hot weather.

Again, we have the layer or cushion of dead air in the upper part of the roof, thus preventing, with a good, felted asphalt roof, the entrance of heat from the sun at a time when the sun is very hot and shining down on the roof at nearly a right angle as compared with the acute angle in winter, and at the same time the house is open on all four sides to every movement of air.

Both summer and winter the litter has stayed in excellent condition without artificial ventilation.

It is obvious that a house of this kind is very much cheaper to build, when the floor and foundation is the same, than an ordinary standard laying house. If we are able to do away with all insulating materials, all artificial ventilation, and still get higher egg production on a smaller proportion of mash and only a slightly higher proportion of grain or, in other words, at a lower cost of feed per dozen eggs produced, why haven't we here a house which is "just what the doctor ordered"?

There are some disadvantages. This house with the floor 24 by 24 feet will not hold more than 200 Leghorns or about 150 of the heavy breed hens, for best results. It is obviously impossible to arrange a series of such houses so that feed, eggs, litter, and droppings can be handled as efficiently as in a long laying house provided with a track and carrier system.

There is also another very important consideration. We have tested this house in the cold climate of central New York (total snowfall last year a fraction over 126 inches and mid-winter temperatures usually uniform and much of the time ranging from 10 above zero to 18 below), only with Red-Rock crossbred pullets that are notably tough and hardy and have small combs. Of course, electric heated fountains were used.

In the year ahead, we are going to test out Leghorns, and this test also will be run for two years.

Alfalfa — The Aristocrat

Condensed from Commercial Fertilizer

Dr. Firman E. Bear

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In Kansas, without benefit of added lime or fertilizer, alfalfa may be practically a permanent crop. In New Jersey, even though the land may have been liberally limed and fertilized, the life-span of this legume is often only three or four years, and all too frequently the crop fails during its first winter. The explanation of this difference in the longevity of alfalfa lies in the soil of these two states. The difference between the soil of Kansas and that of New Jersey is explained by the fact that they are the products of two fundamentally different types of climate. Kansas soil has not been subjected to the leaching action of such heavy rainfall as occurs in New Jersey. Furthermore, a much larger percentage of Kansas' 15 to 40 inches of annual rainfall goes up in vapor than of the 40 to 50 inches that fall on New Jersey.

The alfalfa plant is believed to have had its origin in a relatively dry area, possibly in Persia. There it had adapted itself not only to a semi-arid climate but to the kind of soil associated therewith. A characteristic feature of soil formed under such climatic conditions is its abundant supply of all the mineral elements that plants like alfalfa require, including plenty of lime.

As civilization spread westward from the Orient around the Mediterranean Sea, alfalfa went along, but it continued to cling to the edge of the desert where the soils were rich in mineral nutrients. In due time, this famous forage crop made its way to Spain and Portugal, and from there it crossed the Atlantic to find a new home in the semi-arid and irigated arid lands of Mexico and southern California. Once the American farmer saw alfalfa he wanted to grow it, so the crop moved quickly on to Kansas, Nebraska, and the Dakotas. From there on the rate of movement of alfalfa gradually slowed down, however, until finally it was reduced to a mere snail's pace as it approached the shores of the Atlantic.

Here and there alfalfa was an immediate success, even as far east as New England, once the

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problem of soil inoculation had been solved and the necessary bacteria had been transplanted with the seed. Examination of the soils of such areas usually revealed an underlying deposit of limestone, lime-bearing shale, or calcareous till. Once the roots had penetrated to that depth and the plant was abundantly supplied with the necessary lime and mineral elements upon which it so largely depends, it grew luxuriantly.

But in trying to make alfalfa feel at home in the eastern states, we had the handicap of centuries of heavy rainfall, badly leached, acid soils, and rugged winter climate with freezes and thaws that tended to pull the plant out of the ground, leaving it to lie with its head down and its taproot bent in a semi-circle above the surface of the soil. Our greatest difficulty, however, was not so much the bad weather as the generally low content of lime, phosphate, potash, and other mineral nutrients, both in the surface soil and in that beneath.

It was necessary, therefore, to get rid of the acid in our soils and to supply a large part of the many mineral elements this aristocratic legume requires. It must be kept in mind that alfalfa is accustomed not only to luxury feeding and well-drained soils, but to subsoil conditions that permit its roots to continue downward into the subsoil for long distances without damage either by reason of acidity or lack of aeration. The "tall" stories of Kansas includes some famous ones that alfalfa roots grew down to depths of 125 feet or more. These could be cut in half and still be "tall" enough to meet our requirements. Suffice it to say that alfalfa tap-roots are much longer in Kansas than they are in Pennsylvania and points east.

Second only to having enough lime in the soil and subsoil, our most troublesome nutritional problem is that of keeping it supplied with potassium. The plant has a phonomenal capacity to consume this element. In fact, its tendency in that direction is such that it uses much more than it actually needs, substituting the potassium for calcium and magnesium in certain of their functions in the plant. This does not necessarily result in any lowering in yield, but it is to the disadvantage of the soil's supply of this element and of the animals to which the crop is fed. But the alfalfa plant is concerned only with its own interests, and not those of the land on which it grows or of the livestock that consume it.

Our studies have led us to believe that the life-span of this plant is frequently determined by the dosage of potassium applied

in preparation for seeding. Thus, in spite of the tendnecy of alfalfa to overindulge in this element, we find it desirable to apply from 500 to 1,000 pounds of a 5-10-10 fertilizer per acre at seeding time as an aid in getting the little seedlings under way with a luxuriant growth of both tops and roots before winter sets in. Plants so fed may contain as much as 4 per cent potassium, which is about four times as much as they actually need. This extra supply of the element, however, stands them in good stead during the trying days of their first winter and early spring.

Once the alfalfa plant gets well under way, it then becomes highly important to give it regular and generous doses of potassium every year to prevent the soil's supply of this element from being exhausted to the point where its lack limits growth. Here again, our experience indicates a need to apply between 500 and 1,000 pounds of an 0-12-12 fertilizer, or its equivalent, as a topdressing every year.

During the long winter months, however, considerable amounts of soil potassium become available to the alfalfa. This is picked up by the first crop of the season and harvested with it, with great likelihood that the second crop will suffer for want of this element. Certainly by the time two crops have been harvested during any one season the soil's supply of this element is likely to be at a very low level. Thus, it is common experience to see the characteristic white-spotted leaves that betray the plant's need for potassium during the latter part of the summer. It is our opinion, therefore, that the phosphate-potash top-dressing should not be applied either in early spring or late fall, but during the summer, probably just after the first crop has been harvested.

If one wants to keep a field in alfalfa for 8 or 10 years in the acid-soil areas of the eastern part of the United States, he must be sure that the lime needs of the soil have been abundantly satisfied before the seed are sown. The movement downward of any additional lime might subsequently be applied as a top-dressing is often too slow to permit correcting the acidity as rapidly as it develops in the subsoil.

The case for phosphorus is somewhat similar to that of lime, this element being fixed at its point of contact with the soil, with very little movement downward. Nevertheless, top-dressings of superphosphate are often highly effective on phosphate-deficient soils. Presumably the roots are able to absorb the applied phosphate during periods of soaking rains and, once absorbed, the

element moves both downward into the deeper roots and upward into the tops, more or less in proportion to their needs for it.

Potassium top-dressings present no serious problem. The element moves downward fairly readily into the root zone during periods of rainfall, especially if the fertilizer is applied in the summer or early fall after the soil has undergone the usual granulation processes that permit of more rapid internal movement of air and water. Thus, no difficulty whatever is experienced in removsigns of potassium - deficiency from the leaves of alfalfa plants in season of normal rainfall by top-dressing them with high-potash fertilizers after the first or second harvest.

A study of the conditions in 18 alfalfa fields located at widely scattered points in New Jersey revealed that most of the soils, and the alfalfa growing on them, contained adequate amounts of calcium, magnesium, and phosphorus, the only serious shortage being that of potassium. Thus in four of these fields, alfalfa failed at the end of the second or third year of harvest for no apparent reason except that the potassium supply in the soil had been exhausted. On two other fields, also, a lack of potassium was a limiting factor, but in these cases it operated in conjunction with wilt and winter-heaving to kill the plants.

From our tests (1), (2), (3), the conclusion was reached that the critical lower limit for available potassium in an alfalfa field is between 60 and 80 pounds per million pounds of soil, and that the potassium content of the crop at harvest time should not be less than 1.0 per cent of the dry matter. At such low potassium levels, however, the soil must be able to supply the alfalfa with considerably more calcium than would be required at higher potassium levels in the soil and plant.

Of 20 soils studied in detail, the Collington loam, Penn silt loam, Dover loam, Bermudian silt loam, Dutchess shale loam, Washington loam, and Chester loam had the greatest capacity to continue to yield potassium from their natural stores to the alfalfa crop, and the Lakewod sand, Whippany silty clay loam, Sassafras sand, Gloucester loam, Papakating stony loam, Sassafras loamy sand, and Hagertown loam had the least.

Responds to Use of Borax

In examining the question of other possible soil deficiencies, it was soon found that one of the most seriously limiting factors in alfalfa-growing is a lack of boron. Some 12 per cent of the soils of New Jersey were shown to be

lacking in this element. On such soils, an application of 20 to 40 pounds of borax per acre, applied as a top-dressing to established stands, freqently increased the yield of hay by as much as one ton. From careful studies of this problem the conclusion was reached that the amount of available boron should not be less than 0.35 pounds per million pounds of soil.

Our present thought is that every ton of fertilizer sold in New Jersey should contain at least 5 pounds of borax, but that any fertilizer especially designed for use on alfalfa, on soils known to be deficient in boron, should carry extra amounts of this element. Thus we suggest that farmers in boron-deficient areas, especially those located on Sassafras and Penn soils, apply 10 to 20 pounds of borax per acre at seeding time and that they top-dress each acre of alfalfa yearly with 500 pounds of a phosphate-potash mixture containing 80 pounds of borax per ton.

It seems probable that other minor elements are missing in many soils and that if they were supplied, the life-span and yield of the alfalfa crop would be further increased. The elements under suspicion are manganese, copper, zinc, and possibly molybdenum. As soon as manpower permits, studies will be undertaken by the New Jersey Agricultural Experiment Station to determine whether any one or all of these elements can be used to advantage either as a constituent of the fertilizer to be used on the soil, or as a spray to be applied to the growing crop.

As previously indicated, the disease known as "wilt" and the soil condition that results in "heaving" are two other problems facing many alfalfa growers. Wilt is widespread and is being overcome by breeding wilt-resistant strains, of which Ranger and Buffalo are among the most promising. Heaving is associated with high-rainfall areas and heavy soils and is being circumvented by selecting plants with branching root-systems, rather than the tap-rooted types, for seed production. Of the list, the Atlantic, developed in New Jersey, is rapidly gaining in popularity since it not only is less subject to being pushed out of the soil during spring thaws but it is remarkably tolerant to wilt and has shown very high yielding capacity. Lack of seed is the only deterrent to widespread use of these improved strains of alfalfa.

Factors in the Choice of Fence Posts

Condensed from Agricultural Engineering

Ray Crow
Member A. S. A. E.

THE most economical fence post to use is that which requires the smallest annual payment to amortize the total cost of installation and maintenance, including interest, over a given period of useful life. Unit price and length of useful life are two important factors in this connection, but there are others that also must be considered to determine the type that is cheapest in the long run. The principal factors pertaining to the relative economy of five types of more or less durable fence posts are considered in some detail. Two or more of these types are generally available at widely varying prices in most localities throughout the country.

Table 1 briefly summarizes some of the conclusions arrived at. The items given are general averages only. Actual local figures in each case should be substituted for those in the table to determine local comparisons.

The annual payments required for amortization of estimated costs as shown in the last line of Table 1 were determined from the accompanying chart. To use this chart for determining relative economy of different types of available posts at various prices and having different lengths of service life, proceed as follows:

1. Locate the estimated length of service life of the post in question in the column at left side of the chart.

2. Project a horizontal line to the right to a point that represents the total estimated installed cost of the same post (unit price plus handling, setting and other costs) which will be on one of the curves or proportionally between two of them.

3. From this point, project a line vertically downward to the line of estimated annual amortization payments at the bottom of the chart.

4. The vertical projection that falls farthest to the left indicates the most economical post to use from among those compared and gives the annual cost including interest at 6 per cent. Higher or lower rates of interest change this figure accordingly but will not change relative values.

Local Availability of Various Types of Posts

Steel posts are manufactured by practically all producers of other fence materials and made available through wholesale and retail dealers in such products throughout the country. They are found in stock at or can be obtained by local hardware stores and similar establishments.

Durable Wood Posts. Formerly posts cut from one or more species of timber that would resist serious decay for ten years or more were available in or near almost any locality. At present quantity sources of such supply are limited in size and widely scattered. This condition is rapidly growing more acute. In many sections such posts are only available by transportation over considerable distances.

Locally Treated Wood Posts. The U. S. Department of Agriculture and various state agricultural extension services have issued bulletins describing methods of local treating of non-durable wood posts produced on the farm or in the community. The equipment described ranges from primitive farm installations that cost only a few dollars to community projects running to $1,000 and more. Thus the availability of this type of post is limited to those farms or communities where such plants have been established. So far this type of treatment has not attained a widespread development.

Commercially Treated Wood Posts. Commercial wood-treating plants are rather widely scattered throughout only certain sections of the country. For the most part, therefore, this type of post is generally available only at considerable cost for transportation and distribution. Normally they are stocked at lumber yards for retail sale.

Reinforced Concrete Posts. These are not available commercially except in occasional locations. When used they are generally cast locally near the job from locally available aggregates. Due to the weight, the cost of transportation for any considerable distance is high.

Styles of Available Types

Steel Posts. Various manufacturers feature somewhat different shapes and styles of steel posts. Some types are self-fastening by which a punched-out tongue is bent back over the fence wire. Others are arranged for a staple to be clinched through a hole or slot, and in some cases the fence is wired to the post.

One type (the most expensive) is in the form of a galvanized pipe. Others are either angle, tee, or channel shapes with a painted finish. However, all are engi-

neered for the purpose and thus are generally dependable.

Untreated Durable Wood Posts. Due to scarcity the present tendency is to split such posts into smaller sizes and leave more sapwood attached than was formerly considered at all advisable. Thus the better types are often not widely available for commercial purchase. Some of the most durable woods are practically off the general market.

Locally Treated Wood Posts. The most commonly used preservative is creosote mixed with tar or low-cost petroleum-derived oils applied by boiling. For good results the posts should be open-grain sap softwoods peeled and thoroughly seasoned which requires three months or more. Otherwise, satisfactory penetration will not be secured. Hardwood posts are also treated, but penetration is more difficult. Solutions of zinc and copper salts also are used as wood preservatives, but are not so popular as creosote.

Commercially Treated Wood Posts. These may be round, split or sawed as to shape and of various sizes. The standard treatment most generally used is the application of 6 lb. per cu. ft. of wood of a mixture of 80 per cent creosote and 20 per cent low-cost coal tar or petroleum derivative applied hot in metal tanks under pressure. This insures a uniform dependable job.

Reinforced Concrete Posts. They are usually cast square, tapering somewhat, and reinforced with a minimum of two, preferably four, ¼-in. round or deformed reinforcing steel rods located near the corners and tied with wire. Any good aggregate can be used.

Retail Unit Prices

Steel Posts. These vary somewhat, depending on type, distance from factory and method of distribution. As indicated in Table 1, the present retail prices generally range from 45 to 55c each for the painted steel posts. Local conditions and quantities required may develop somewhat higher or lower prices.

Durable Wood Posts. These vary so widely depending on species of wood, size and uniformity of post and distance from source of supply that only suggestions can be given here. Only occasionally are quotations made of less than 30c each and this for small sizes and/or less durable wood near a source of supply. For larger posts and more durable woods at greater distances, the quoted retail prices range up ot 50c and more each. Size of wood posts, as well as species of timber, have much to do with service life. Therefore, they

should be carefully inspected before purchasing at any price.

Locally Treated Wood Posts. This type of post is seldom available commercially. The cost usually is made up of (1) the value of the stumpage, (2) labor cost of cutting, splitting, peeling and stacking for seasoning, (3) transportation to and from treating plant, and (4) cost of preservative and its application. A 4-in. in diameter by 7-ft. long post should absorb at least 3.5 lb. of preservative. The actual cost of this will range from 11 to 15c or more, depending on the amount of dilution of creosote with cheap oil. In addition will be the cost of application.

If reasonable rates of pay are allowed for the latter and the other labor and transportation items mentioned, it will account for the minimum cost of 30c shown in Table 1.

Commercially Treated Wood Posts. These vary widely, depending on distance from a treating plant and methods of distribution. Most plants quote prices both for treating service, only if seasoned wood posts are brought or shipped to them, and also for posts for sale direct.

In the southeastern states treating only of a 4-in. diameter 7-ft. long post, or one of equivalent volume, is quoted at 23¾c in lots of 250 to 1,000, other sizes and lengths in proportion. To this must be added the cost of stumpage, labor for cutting, peeling and stacking for seasoning, and transportation to and from plant anywhere up to 100 miles or more.

Reinforced Concrete Posts. These posts are seldom sold at retail on a commercial basis. However, with suitable aggregates of sand and gravel locally available they can be cast on a farm at surprisingly low cost. Pre-war records were as low as 35c each. At present the minimum probably will be 45c with the average much higher. Of this, from 10 to 20c will be the cost of the reinforcing steel. To cast these posts in quantity requires a large number of forms and considerable space.

Length of Usable Life of Various Types of Posts

Steel Posts. Thousands of painted steel posts are still in use after 20 to 30 years of service with little corrosion or other evidences of failure. On occasion, highly acid soils will cause deterioration in a shorter time, but this can be prevented by coating the lower three feet of the post with neutral asphalt before driving, an inexpensive operation. Highly acid soils are not widely prevalent but this condition should be checked in any community to determine necessity of protection.

Untreated Durable Wood Posts. In reasonable sizes the average length of life of a few species used for posts where available are, according to the "Farm Fence Handbook," published by the Republic Steel Company, as follows:

Osage orange	30 years
Black locust	24 years
Red cedar	20 years
Catalpa	16 years
Longleaf heart pine	25 years
Cypress	20 years
White oak and post oak	10 years
Tamarack	10 years

However, these figures are averages only. The service life varies with the rapidity of growth, location, age and other factors pertaining to the trees from which the posts are cut.

Locally Treated Wood Posts. This will vary so widely, due to quality of preservative used and amount of penetration attained, that any definite statement is not justified. This type of treatment can do a good job if properly handled by experienced operators. The difficulty is in determining whether or not the post is effectively treated. One tendency that must be watched is to attempt the treatment of posts that are not sufficiently seasoned or that are too wet.

Commercially Treated Wood Posts. This depends on the size of the post and the amount and quality of the preservative. Many such posts are in use after 20 years and more of service. Others have, of course, failed at much less. It is thought that the length of life estimated in Table 1 is a fair average.

Reinforced Concrete Posts. A well-made reinforced concrete post can be considered practically a permanent fixture. They are sometimes carelessly handled in the casting and curing in which case they may spall and split in even a few years.

TABLE 1

Item	Steel Posts	Durable Wood	Locally Treated	Commercially Treated	Reinforced Concrete
Length of life, years	20 to 25	10 to 20	10 to 20	16 to 24	30 to 40
Weight each, lbs.	8 to 10	16 to 35	20 to 40	20 to 40	100 to 115
Fire resistance	Full	None	Partial	Partial	Full
Set by	Driving	Holes dug	Holes dug	Holes dug	Holes dug
Installation costs—					
Unit price, cents	45 to 55	25 to 45	30 to 50	40 to 60	45 to 70
Handling, etc., cents	1 to 1	2 to 3	2 to 4	2 to 4	12 to 13
Setting, cents	3 to 3	10 to 12	10 to 12	10 to 12	12 to 15
Grounding, cents	0 to 0	1 to 1	1 to 1	1 to 1	1 to 1
Total cost in place, cents	49 to 59	38 to 61	43 to 67	53 to 77	70 to 99
Annual cost, cents	4.3 to 4.6	5.2 to 5.3	5.8 to 5.7	5.2 to 6.1	5.1 to 6.0

Transporting, Handling and Setting

Steel Posts. Steel line posts weigh only 8 to 10 lb. each and occupy extremely small space. They can be lined and driven by one man at the rate of 10 to 15 per hour in average soils, a setting cost of 3 to 4c depending on labor rates. Thus transportation, handling and setting costs are much less than for any other type of ordinary available post.

Untreated Durable Wood Posts. Durable wood posts weigh from 16 to 35 lb. or more each when well seasoned, depending on size and species of wood. They are bulky to handle and transport and two men can set only 6 to 8 posts per hour in average soils. Usually holes are dug to full depth with a spade or posthole auger, the post set to line and the earth backtamped. They can be driven by using a heavy maul after sharpening the post and setting it in a pilot hole made with a chisel bar or pointed rod. However, but little if any saving of labor is made over digging in.

The labor cost of setting a wood post will range from 10 to 15c or more, depending on price of labor and soil conditions.

Locally Treated Wood Posts. Practically the same as for untreated wood.

Commercially Treated Wood Posts. Practically the same as for untreated wood.

Reinforced Concrete Posts. These posts weigh 100 lb. or more each, and thus require two men to handle. The operations of transporting, handling and setting are considerably more expensive than for any other type of posts ordinarily available.

Dependability of Service

Steel Posts. Steel posts, if of a given type and make, are uniform in character as well as in appearance. They are engineered to serve a certain purpose and thus one is as dependable as another.

Durable Wood Posts. Wood posts are irregular in size and shape and vary widely in strength and lasting qualities from tree to tree, even in timber of the same species. In any line of fence at least a few of the posts will fail long before they are supposed to from no apparent cause.

All Treated Wood Posts. These are somewhat more dependable than untreated when a uniformly good job is done.

Reinforced Concrete Posts are entirely dependable when well made.

Neatness of Appearance

Steel Posts. Steel posts are uniform and clean-cut in appearance. They make a fence out-

standing and add much to the sales appeal of the farm.

All Wood Posts, when reasonably uniform in size and shape, present a neat appearance, of course, but this is often not the case.

Reinforced Concrete Posts usually present an impressive appearance of neatness and strength that has a strong sales appeal.

Comparative Cost of Removal and Reinstallation

Steel Posts can be removed and reset for at least 10 to 15c less cost than can any other type. This factor has no importance unless the fence is moved, but a certain value is there, inasmuch as changing farming operations may dictate changing a fence location at any time.

All Wood Posts generally decay at the ground surface, leaving a neck there with the full size remaining under ground. This makes pulling difficult and in shaking the post loose it often breaks off at this neck, but would have been serviceable for several years if left in place.

Reinforced Concrete Posts. Due to the heavy weight, pulling and resetting these posts is more expensive than that for other types.

Protection from Hazards

Steel Posts will not burn. A fence row fire will have little or no effect on their service life. If too hot, it may injure the galvanizing on the fence.

Steel posts automatically ground lightning charges that strike the fence. This may prevent injury to livestock at a distance from the point of striking.

Untreated Wood Posts. Some care and attention is required to prevent fire damage to wood posts by the burning of fence rows.

Many authorities recommend that when wood posts are used, the fence should be efficiently grounded at intervals of 8 to 10 rods as insurance against injury to livestock by lightning running along the fence from point of striking. This is done by attaching a heavy steel or copper wire or a steel rod or pipe firmly to the fence and sinking it to moist earth. The cost will amount to at least 1c per post.

Treated Wood Posts are more resistant to fire than untreated posts. Otherwise the same conditions apply as to untreated posts.

Reinforced Concrete Posts will not burn. Grounding of lightning same as for wood posts.

Annual Payments to Amortize Cost Including Interest

All Types. This can be estimated by reference to the chart when interest at 6 per cent is considered.

General Conclusions

The foregoing discussion pertains to line or intermediate posts only. Corner and end posts are larger and heavier in each type and correspondingly more expensive, but the same relative conditions apply.

It would appear from the foregoing that steel posts are worthy of careful consideration when fence posts are required.

Ergotism . . .

Condensed from The Aberdeen-Angus Journal

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Ergotism is an ailment affecting cattle, swine and fowl—less frequently horses—due to the consumption of the fungus ergot growing on rye and sometimes on other grasses. Rabbits, dogs and cats are seldom affected.

Ergot—the old German name is mutter-korn ("mother corn")—is the resting stage of a parasitic fungus which infects the flower of the rye plant in particular and occasionally wheat, oats, barley, and other cereals. In this infection ergot, in the form of hard dark brown or nearly black filament masses, replaces the kernels of the plant fruit, and appears in the form of somewhat curved rods, tapering towards both ends, varying from three-eighths to six-eighths or more in length and approximately one-eighth inch in its greatest diameter. It breaks easily, disclosing a white or pinkish interior. These hard kernels tide the fungus through the winter so that it is ready to repeat its life's cycle in the spring. Ergot is produced commercially in Poland and Russia, and in parts of Spain and Portugal. Its presence has been reported from many sections of the United States as an indigenous fungus.

Various pharmaceutical preparations of ergot and of some of its active principles are extensively used in human and animal medicine. It is the only fungus in general medicinal use in the greater group of vegetable drugs. It has a slow persistent action in causing contraction of the muscles of the uterus so that it is of value to assist by pressure on the capillaries of this organ in the control of bleeding following the separation of the fetal membranes. It produces contraction also of capillaries in other parts of the body.

There is some divergence of opinion among veterinarians about the poisonous or harmful effects of ergot upon grazing or

grain-consuming animals. One explanation of this is the conditions under which it grew and the stage at which it was harvested. Its failure therefore to produce results in a given case cannot be accepted as disproving its harmful properties.

Also non-pregnant animals do not appear to suffer ill-effects from comparatively large doses of ergot. As an illustration of this as much as two pounds of it have been given to a horse over a period of four days without noticeable illness. *But when ergotized grasses or grains are consumed by stock for a prolonged period it accumulates in the tissues and its harmful effects—ergotism—result.*

Ergotism is characterized by sloughing of the extremities—lower portions of the limbs, end of the tail, tips of the ears and others—because the fungus contracts the capillaries, and as the blood supply of the extremities under normal conditions is not too rich, the parts that should receive nourishment through these avenues undergo local starvation, or as the veterinarian designates it "dry gangrene." Cold weather assists in this process, though ergotism is by no means uncommon during the warmer seasons. Other usually less noticeable symptoms of ergotism are muscular twitching, convulsions and paralysis.

Abortion or premature birth of the young may also occur in ergotism, but is comparatively rare affecting most frequently only isolated animals. *As a general rule when an abortion occurs in a herd it is best to regard it as being brucellosis (Bang's Abortion Disease) until its non-contagious nature has been demonstrated.* To disregard this rule is to invite disaster. If by proven tests the non-contagious nature of the abortion has been established, then the previously set up quarantine procedures may be relaxed.

There is no specific treatment for ergotism. The feeding or grazing of ergotized material must be discontinued as soon as its nature is recognized or suspected. The veterinarian should be called to prescribe for local and symptomatic handling of the patient. Threatened abortion because of ergotism is seldom recognized in time to stop it—in fact when it has reached the stage of recognition, the unborn young is already a "foreign body" as it were, and the veterinarian may judge it desirable for it to be removed rather than to attempt to retard its birth.

Corn Smut found on the maize plant is a related fungus, and stock-raisers have ascribed to it harmful effects comparable to those observed in ergotism.

Love of the Land

Condensed from Land Policy Review

Bristow Adams

THERE'S no other word for it. Some folks may speak of land-mindedness, but that does not tell half. Love of the land comes nearest to the sentiment that prompted the Polynesian saying: "The land is the only living thing. Men are mortal. The land is a mother that never dies."

Though all persons do not have a love of the land, anyone may have it, and be fully conscious of it. It is not the exclusive possession of the farmers nor of those who live in the country.

Nor do all farmers possess it. Some farmers, who perhaps do not deserve to be farmers, entirely lack affection for the soil they till and that helps to feed them. Others actually hate it with an unchanging hatred, and long for the day when they can be "shed of it." As a generality, never wholly true, the successful farmer has a genuine feeling for land. Yet some may love the land and not know how to treat it, affectionately or otherwise.

On the other hand, some city men and women have a strong sentiment for the land though they have never turned a sod—except perhaps with midiron or niblick—nor have they ever lived in the country, nor had immediate forebears who made a living from the soil. Such a man never wearies on a train journey thru our States wherever he may be. Watching from the window he appreciates the landscape to the full as it flows past. He not only admires it for its beauty—he senses its construction and its variety and its possibilities. He notes its very anatomy as well as its clothing, particularly as shown in late winter or early spring, where lingering snow accentuates land structure in shaded hollows or on north slopes.

He notes the changes in the landscape as the train leaves level areas of cultivated crops for rounded hills of pasture lands which in turn give place to groves of hardwood trees, with here and there a few hemlocks, until he reaches a summit covered by conifers. His eyes seek the mountain tops with their varying peaks, and he notes again, with never-ending surprise, how the whole scene appears to flatten when he views it from the crest.

Those who are conscious of

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their love for the land personalzie it in their thoughts. They think and speak of the intimate charm of the farm lands of the northeast, of the austere and forbidding aspect of the Rockies, of the restfulness of desert solitudes.

This sentiment for the land, even among persons who give no other evidence of sentiment, sometimes hinders the efforts toward rural rehabilitation and resettlement as those who have worked on these plans for rural betterment well know. Where a man has tilled the soil, even for a poor reward in crops or with constant threat from drought or overflow, he often has a feeling for his acres that makes him loath to leave them. When he turns up a row of potatoes on his own farm he gets a thrill akin to that of the prospector who sees golden color amid the sands he washes.

Those who do not feel such an emotion in the course of their daily lives miss something that nothing quite replaces and that cannot be described to one who is insensate to the call of the soil, from which all life comes and to which all life returns.

Safeguarding Power Driven Farm Machinery

Condensed from New England Homestead

E. W. Tanquary

Chairman, Advisory Engineering Committee of the Farm Equipment Institute

Did you ever pick up a newspaper and read an article covering injury to a farmer where a corn picker started up of its own accord, hunted up the farmer and pulled his arm down between the snapping rolls, or where a tractor chased a man across a field, pushed him into a ditch and then jumped on him? Yet you have seen articles covering accidents where a farmer's arms were injured in a corn picker and where a tractor tipped over a ditch bank and pinned the operator underneath. If the tractor or corn picker was not the aggressor—and the farmer certainly was not—why did the accident occur?

To determine this, members of the Farm Equipment Institute Safety Committee and Advisory Committee of Engineers studied and analyzed several hundred reports of farm accidents received from farm equipment sales representatives from all sections of the country and covering all makes and types of farm machinery. Corrective measures in design

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were indicated and corrections made. Shields were provided, projecting parts eliminated, and farm equipment engineers became, and are, safety conscious in designing farm equipment.

Power-driven machinery, combines, corn pickers, mowers were given particular attention and through action by the American Society of Agricultural Engineers a new standard covering the location of the power take-off shaft and drawbar hitch point was developed and adopted by practically all farm equipment manufacturers. Adoption of this standard makes it possible to use any make or model power-driven implement with any make or model of tractor with the assurance that the power line safety shield furnished with the implement can be attached to the mastershield bracket on the tractor.

Recognizing safe operation of the power line was just as important to the owner of old equipment as to the purchaser of new equipment, the engineers have so far as possible worked out, and tractor dealers can supply, conversion packages for tractors already in the field that were built prior to the adoption of the standard.

This important work of the FEI Safety Committee and Advisory Engineers is continuing and efforts are being made to make farm machinery even safer to operate. Yet continued study of farm accidents and farm machinery has revealed that certain features of farm machinery, such as cornpicker rolls, mower knives, tractor speeds, must be considered as functional elements and that elimination of accidents in some cases can only be accomplished by care on the part of the operator.

Instruction manuals furnished with the equipment point out these functional elements, call attention to unsafe practices and list safety rules to follow so that unnecessary accidents may be avoided.

Recognizing the operator cannot carry his instruction manual to the field, the Safety Committee has just approved a new porcelain enamel sign with five basic safety rules to be placed on power take-off driven implements in the most conspicuous place for the operator. It is anticipated that the enamel sign will stand up under all conditions and serve as a warning throughout the life of the implement.

The five safety rules were not selected at random or taken from a book but were carefully developed through joint action of Safety and Advisory Engineering Committees, after their analysis of farm equipment accident reports. They cover the five prin-

cipal causes of accidents with farm machinery and if these five basic rules are followed there will be a substantial reduction in farm machinery accidents.

1. *Keep All Shields in Place*—The best designed and most expensive shield ever provided is worthless if left in the implement shed and the implement operated without it, yet accidents are reported where ample shields were provided with the implement, but left off through carelessness. Sometimes it is necessary to remove a shield for servicing but, remember, a few minutes spent in replacing it may safe a lifetime of regret. Shields are provided for your protection, keep them in place.

2. *Stop Machine to Adjust and Oil*—Many accident occur when adjusting and oiling machinery in motion—your wrench may slip; your sleeve get caught in a sprocket or some moving part, or your feet slip throwing you against a moving part. It only takes a minute to stop and start your machine and accidents of this kind do occur; so play safe, stop your machine before making any adjustment or oiling.

3. *When Mechanism Becomes Clogged, Disconnect Power Before Cleaning*—When attempting to relieve a clogged mechanism, remember the obstruction will many times clear unexpectedly with the result your hands or feet may be drawn into the machinery along with the material causing the clogging unless the power is disconnected before attempting to clear the mechanism.

4. *Keep Hands, Feet and Clothing Away from Power-Driven Parts*—Avoid reaching around or climbing over any power-driven parts; your clothing can easily be caught on any moving part, you may slip and be thrown off balance and your hand or foot drawn into the machinery. Avoid loose clothing particularly. Remember loose sleeves or overalls will wind around a smooth round shaft in motion just as quickly as around a square shaft. If necessary to work around on power-driven implements, disconnect the power before doing so.

5. *Keep Off Implement Unless Seat or Platform Is Provided. Keep Others Off*—You may see what appears to be a good place to ride but keep in mind the implement may drop into a ditch or hole or one wheel run up on a rock, the tractor stop or suddenly throw you off balance and into the machinery or out in front of it.

Be Careful: Read the five safety rules and observe them faithfully. Remember! *The Best Safety Device Ever Known Is a Careful Operator.*

Producing Twins at Will

Condensed from The Shorthorn World

J. Hammond, Jr.
Cambridge University

RECENT experiments at Cambridge have demonstrated the possibility of causing a cow to shed more than one egg at a time, and so of producing twin or triplet calves at will. It must be stressed that the matter is still in an experimental stage, but it is thought an account will be of general interest.

Before giving an account of the experiments it is necessary to outline the reproductive processes involved. In the ovaries are stored a great number of unripe eggs, each of which is held in a follicle, a small vessel filled with fluid. A few days before heat one of these follicles begins to enlarge until at heat it is the size of a house sparrow's egg, or rather larger. After the end of heat the follicle breaks and the fluid washes out the egg into a funnel at the top of a small tube which leads to the womb. The egg takes about three days to pass through the tube.

Meanwhile the wall of the ruptured follicle thickens to form the solid corpus luteum, or yellow body, filling the space formerly occupied by the fluid-distended follicle. After about three weeks the yellow body dies away and another egg is ripened and released. If the cow is successfully served the egg is fertilized at the top of the tube, and the yellow body instead of dying away persists until shortly before calving.

A skilled operator can follow these changes in the ovary by manual examination and can easily remove the yellow body by applying pressure. This is sometimes done as treatment for cows not showing heat, and for some types of sterility.

The pituitary gland regulates the changes in the ovary and substances from the ovary produce the body changes and interact with the pituitary. One pituitary substance, known as follicle stimulating hormone, causes the eggs to mature, and another the release of the egg and development of the yellow body.

The follicle in turn liberates material responsible for the signs of heat and the yellow body prepares the womb to receive the fertilized egg. The yellow body prevents follicles maturing; when

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it is removed an egg is shed after about four days instead of three weeks after the last heat.

A follicle stimulating substance is found in large amounts in the blood serum of mares in early pregnancy. This substance is now prepared in this country. It is at present being used to treat heifers whose ovaries become inactive in the winter months. This also is the substance used in the twinning experiments.

First experiments were done on cows entered for slaughter by the Ministry of Food, and were much helped by the ready co-operation of the farmers in the Cambridge area and the officials concerned. Different doses of the mare serum were given; some were injected soon after heat, some shortly before heat was due. In others the yellow body was removed from the ovary and the interval between the injection and yellow body removal was varied. At the slaughterhouse the breeding organs were examined, and if any eggs had been shed they were washed out of the tubes.

It was found, as might have been expected, that the number of follicles developed was generally proportional to the dose given but the number of follicles ruptured (which is the same as the number of eggs shed) did not behave in nearly so simple a fashion.

If there was an active yellow body in the ovary the follicles developed, but usually none of them ruptured; the yellow body prevented it. On the other hand, if the yellow body was removed first, normally one follicle developed before the rest, shed its egg, and then (as it formed a fresh yellow body) prevented the other follicles from rupturing.

But where the mare serum was injected and the follicles allowed to develop first, and the yellow body was then removed, all the follicles ruptured a day or two later. One cow treated in this way shed no fewer than 30 eggs at once. Another way to get more than one egg shed was to inject just before the yellow body died out naturally.

The next step was to produce not eggs but calves. There were not many animals for this to be done on; it was tried on the small herd of Dexters at the Animal Research Station. Both methods of treatment have been used. Two sets of twins and two of triplet calves have been born, and cows which have shed two, three and four eggs are now in calf.

Before the treatment can be applied to practical use there are several difficulties which must be overcome; fortunately the price of the material is not one of the greatest—at present the dose re-

quired costs about seven shillings, the equivalent of about $1.50.

It must be remembered that nine out of ten heifer calves twin to a bull are sterile, and the difficulty of identifying the tenth makes it not worth retaining for breeding purposes. As a result were every cow to produce twins instead of a single calf the number of normal heifer calves born would be quite unaltered; if triplets were produced the number would in fact be less. Introducing twinning only increases the number of steer calves and can be of no value with dairy cattle.

With beef animals, however, there are considerable potential advantages. Under favorable climatic conditions twin calves should thrive, though triplets would probably not be worth the extra care they would need. The overhead cost of production per calf would be cut almost in half; and, where the present system is practiced is to buy in a calf to rear with the other, it would mean being able to fatten two good beef animals instead of one good—and one not so good.

For practical use it is obvious that the number of eggs shed must be controlled at two and no more. This is where the difficulties arise. From the experiments it seems that, giving a single injection, more consistent results are obtained if treatment shortly before heat is practiced.

But the serum must be given at just the right time; with a herd in dairy management this would be easy, but it is not so simple in cows running out all the time and suckling calves.

The method involving removal of the corpus luteum seems at present unsuitable, but may be adapted to give satisfactory results.

There will remain the obstacle that it involves more handling of the animals than is usual under range conditions.

Size of Silo

Size of silo to be built or bought depends on the number of cows to be fed and the length of the feeding season. To keep silage from spoiling during warm weather, two to three inches of silage must be removed each day. So the cross section size of the silo will depend on the number of cows, while the height of an upright silo, or length of trench silo, will be determined by the length of feeding season. A cubic foot of silage weighs about 35 pounds, and cows may eat from twenty to forty pounds of silage a day. Poor feed will result from a silo too large across, because the silage will spoil before it can be fed.

—*Shorthorn World*

Balanced Sods in the Apple Orchard

Condensed from The Eastern Fruit Grower

Fred V. Grau

Director, Green Section, U. S. Golf Association

BALANCED sods in the orchard are to the fruit grower what good hay and pasture sods are to the livestock farmer. They represent an advantage by which an equilibrium is maintained between the cash crop and the soil. Continued production consists of maintaining a balance between opposing forces. In the orchard the opposing forces are represented by loss of topsoil through erosion, loss of nutrients by leaching, loss of organic matter by accelerated decay, loss of moisture-holding capacity in the soil, loss of ground cover by poor management practices. These opposing forces are largely balanced by means of good sods which in turn must themselves be balanced against other factors.

According to the best evidence, a truly balanced sod is roughly half grass and half legume. An all-grass sod requires abundant supplies of nitrogen and can make none. An all-legume sod produces nitrogen in excess but builds little organic matter in the soil. By combining the two, the nitrogen-hungry grass is fed by the nitrogen-gathering legume and organic matter is built at a more rapid rate by the union. The production of dry matter of the balanced sod as compared with an unbalanced sod in represented by these figures:

Pounds dry matter per acre:

Grass alone 3000
Legume alone 4000
Grass plus Legume 6000

The species in a sod must be balanced against the forces of climate if the sod is to be effective.

A sod must be balanced against certain soil conditions. Low organic matter content is a frequent opposing factor in orchard soils. This means lower moisture-holding capacity and poor physical condition of the soil. Where this occurs it is important to select those species which tolerate these conditions. Red fescue grows better than many other grasses under these adverse conditions. Kentucky bluegrass thrives best where the soil is relatively high in organic matter and holds moisture well. Ladino clover grows best where soils are high in fertility, organic matter and moisture. Sweet clover, birdsfoot trefoil and lespedeza, on the other

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hand, tolerate the more unfavorable conditions of low organic matter and low moisture holding capacity.

In order to have a balanced sod for different types of management there are two types of sod to consider. First, the temporary sod which is destroyed regularly at a certain season and then re-established, and second, the permanent sod which is desired to remain productive for many years. With the permanent sod, two types of management are practiced; first, periodic mowing to control seeding of weeds and certain undesirable grasses; and, second, an almost complete neglect of mowing which, with certain species, produces an undesirable, unbalanced sod which largely fails in its intended purpose.

A temporary sod should be one which is readily destroyed but which can be re-established quickly and easily. Ryegrass and lespedeza or ryegress and vetch are balanced temporary sods which will fill most requirements. Permanent sods which require frequent mowing for best results are Ladino clover - grass mixtures. Where little or no mowing is likely to be done, a better balanced sod may be red fescue and birdsfoot trefoil or bluegrass-birdsfoot. It is recognized that Ladino clover is one of the better orchard covers and also that birdsfoot trefoil is as yet practically unknown to orchardists. But from the standpoint of a balanced sod against some of the stated opposing forces, I submit that there may be improvements over the sods now in use. In many cases it will come down to a decision as to whether to select a balanced sod which you like and want to grow and then to condition the soil and your management to fit that sod, or whether to select the balanced sod that fits the ready-made conditions. The decision is forever and unalterably one which you, as an individual, must make.

Some sods may be better balanced than others in their effect on the main crop—the fruit crop. It is generally agreed that deep-rooting alfalfa may compete too seriously with the trees for moisture during critical periods. The same would be true of sweet clover if it were allowed to grow to maturity. A sod which tends to become dormant during dry spells, such as bluegrass or red fescue, offers little competition for moisture. Likewise, it has been indicated that certain sod crops harbor diseases and insects of fruits worse than others. Proper balance here would indicate selection of those sods that are least competitive to the main crop.

Thus far, we have discussed those factors which necessitate balanced sods together with some of the advantages of balanced sods. The next step, and the one in which many of you are interested, is that of how to establish and maintain them to the best advantage.

Establishing the sod: recent experiments on pastures and hay fields prove that the simplest and most effective method of establishing a grass-legume cover is to destroy existing vegetation in the fall by discing. I'm not telling you anything new. You've been discing or ripping your orchard sods with the orchard cultivator and similar tools for years. The important thing is that the lime and fertilizer are worked into the soil in the fall where it is ready to go in the spring. Leaving the trash on the surface prevents erosion and greatly aids in the absorption of moisture. You might think that the rough surface wouldn't be much of a seed bed. If you think that way, you will probably be wrong. When the seed is sown on the frozen soil about the time honey-combing takes place you will find that the seed will find as good a place to germinate and grow as though you used a drill. More than this, the rotting organic matter acts as a tonic to the young grass, and the early quick start gets the grass 'way out ahead of the weeds. Spring preparation is all right if you didn't get it done in the fall but the seeding is bound to be later, weeds will be worse, and the live grass cover over winter is bound to harbor mice. I am not advocating the destruction of the ground cover every fall—not by any means. I'm talking to those of you who do not have the "balanced sods" that you need and who may be in the business of establishing a different kind of a sod from the one you have.

If your soils are highly productive and your fertilizing program has been of the highest type, you may not need any additional fertilizer. But when sods are thin, weeds are prevalent and the need for fertility is evident, don't waste good grass and legume seed by sowing it on unfertilized soil. It is too precious to waste in these days of three dollar Ladino and seventy-five cent fescue. Where fertilizer is needed use a recommended fruit fertilizer. A good complete fertilizer will be best for the grass seeding—say 400 to 500 pounds to the acre of an 8-16-16 or 4-12-12. Next best is an 0-1-1 ration, 0-12-12 or 0-14-14 at around 500 pounds to the acre. Legumes need ample supplies of phosphorus and potash, especially where no manure can be supplied. The important thing

is to get the fertilizer worked into the soil during the discing operation. Experiments have shown that the fertilizer is not lost during the winter when the trash is left on the surface. You may say that a program like this is going to cost money. True, but an orchard can be no better than the cover, and the cover will be the first to tell you when the fertility level begins to drop.

The selection of the kind of sod to grow is one of the important phases of having balanced sods in the orchard. No matter what you may select in the way of grasses and legumes, mowing will be essential for the good of the sod itself. Young grass and clover plants are easily choked by weeds, and weeds are bound to be present in a good soil. One exception is Orchard grass which seems to be able to survive even under a heavy weed cover. I wonder sometimes if it didn't get its name by the very fact that it was one of the few grasses that could survive the rough treatment and the heavy competition.

Ladino clover seems to be an outstanding favorite among orchardists. It is a newcomer to us but an extremely popular one. It grows well on most of our soils but does best where the soil is rich and moist, or where the frequently-clipped growth is allowed to fall to the ground. Consider now that the leaves and petioles of Ladino clover may analyze as high as 38 per cent protein on a dry basis, which is equivalent to about six per cent nitrogen, and that the total dry matter production of a good Ladino soil in a year may be as high as two tons to the acre. Now you can begin to realize that with a balanced sod there is a lot of nitrogen being fed to the trees out of the air by way of the Ladino clover. Better than that the loss of calcium, phosphorus and potash will be small because the roots continue to draw these minerals from the soil and re-deposit them on the surface where the leaves decay and return the minerals to the soil in an available form.

Ladino clover will be most successful under these conditions:

1. A "sweet" or neutral soil.
2. Ample balanced supplies of phosphorus and potash.
3. A solid seed bed.
4. Surface seeding on frozen ground in late winter.
5. Sowing one to two pounds to the acre with *light* seedings of non-competitive grasses like timothy or red fescue (not over five pounds to the acre of the grasses). Right here I want to say that I have been impressed by the seedings of Ladino clover in the College orchards where a few pounds of sweet clover seed were added. Where the sweet clover

was clipped back when it got up to a foot high, it was non-competitive and seemed to greatly assist the Ladino clover.

6. Clipping the growth back with the mower bar set at four inches to leave a good ground cover, clipping frequently enough to *control weed growth* and to *prevent the re-seeding of grasses* at any time. When grasses are allowed to go to seed, from 100 to 400 pounds of seed to the acre go back on the soil. If only ten per cent of these seeds grow it is enough to discourage or smother any legume.

7. Permitting the Ladino clover to bloom freely in July and August and to reseed itself as an insurance policy against winter injury and freezing out in late winter and early spring. Data show that from 15 to 70 pounds of Ladino seed may be produced to the acre in a good stand where bees are present to work the blossoms. If this program is followed, your first purchase of Ladino clover seed may be your last. Hay cut in August when the heads are full of seed may be scattered and disked into the soil on other areas where you want to get it established. This is like the seed-mulch method used on airfields. It is simple, cheap, and very effective because the hay greatly helps in establishing the seed by holding moisture and by keeping the soil cool and porous. This principle can be used with any grass or legume which you may want to grow.

We have mentioned timothy and red fescue as being relatively non-competitive to Ladino clover. Neither is so aggressive as Orchard grass which is objectionable because of the large clumps that develop with age. If Orchard grass were not so bunchy, it would stand off any other grass because it is a good companion with Ladino clover where it is kept down by frequent clipping. One of its chief virtues is its shade tolerance. Fortunately, red fescue is just as shade-tolerant as Orchard grass and it develops a low smooth tough turf that will take plenty of punishment. Creeping red fescue is to be preferred over Chewing fescue because Chewings tends to be bunchy too, although they are neither so large nor so objectionable as Orchard grass.

Timothy has the advantage of maturing seeds late in July so that you have more time to get it mowed before the seeds are ripe. The sod it makes is neither heavy nor tough but makes a good substantial cover.

Kentucky bluegrass does not produce balanced sod with Ladino clover in Pennsylvania. It tends to smother the Ladino in about the second or third year

under normal conditions. On rich soils Kentucky bluegrass tends to come in on its own accord, probably from seeds that are in the soil. This is a natural occurrence that we can't do much about and don't intend to.

Canada bluegrass does not fit too well with Ladino because they have different adaptations. Canada bluegrass will do well on poor, thin, dry soils where Ladino cannot be expected to thrive. Otherwise, Canada bluegrass makes a low-growing tough sod that will take a lot of hard wear. We've sowed a lot of it in Ladino mixtures for poultry ranges and have yet to see much of it so there is not much use seeding it in Ladino mixtures.

We have mentioned birdsfoot trefoil but have not recommended it as an orchard legume. But, because of some of its characteristics, it deserves some discussion and, in some orchards I have seen, birdsfoot would be a big advantage over the existing cover. It is a drought-tolerant legume and it is a long-lasting perennial which reseeds itself each year at the rate of 40 to 60 pounds of seed to an acre. During extremely dry seasons I have observed that, under a heavy cover of birdsfoot, the soil stays quite moist. It has the distinct advantage of being able to compete successfully with tall-growing grasses, even though the cover is not mowed. It will grow on soils of low fertility and low organic matter better than Ladino clover. The root system is much more branched and fibrous than alfalfa and it is believed to require less moisture in a dry season. It will grow better in a balanced sod with more of the grasses than Ladino clover. With Canada bluegrass it looks like a "natural." Some of its disadvantages include: (1) difficulty of establishment. (2) taking three years to become fully established. Special birdsfoot inoculant is an absolute requirement and I have found through experience that it pays to double-inoculate with commercial inoculant and also with soil from old established plants. Lime and fertilizer requirements are lower than for Ladino but it responds to good treatment. A very important factor is to seed the very minimum of grass with the birdsfoot and also to destroy the existing cover completely so as to permit the seedlings to start with the *least competition.* So far as adaptation is concerned, I have seen it growing successfully in Montgomery County, Penna., on a gravel pile in Erie County, on rocky hillsides in Susquehanna and Bradford Counties, in Cambria County, Centre County and in Clarion County. Five pounds of seed to the acre is recommended for good

stands, but good catches have been obtained with two pounds. It can be seeded in late July or in late winter on honeycombed soil.

I shall say very little about crown vetch except to say that it looks very promising. No seed is available commercially but plenty of root-crowns are available for the digging. It grows well and competes with almost every grass and has a large capacity for taking punishment.

So far as lespedeza is concerned, I think most of you are familiar with the limitations of this legume. It is definitely limited to the southern counties in Pennsylvania. Being an annual, it must reseed itself each fall in order to persist. The early strain of Korean called 19604 seems to be adapted farther north than the common types. Most of this seed is produced in Indiana and there seems to be plenty of it.

Temporary sods: It will probably be a long time before we find a better grass than ryegrass for temporary cover. The improvement to expect probably is in the selection of a rapidly-growing annual legume which will give us more balanced sod than ryegrass alone. There have been quite a few abortive attempts at this phase of maintaining a 50-50 grass-legume cover where the sod must be destroyed annually for orchard management reasons. It may be neither feasible nor desirable so long as you are getting such good results with ryegrass alone but we can always look forward to improvements so long as research continues to function.

Acidophilus Milk for Calf Scours

Condensed from Hoard's Dairyman

I. R. Jones

Scours or dysentery is probably the most serious disease affecting calves. Ravages of the disease result in the death of many valuable calves and cost breeders and dairymen many thousands of dollars annually.

Many different bacteria may cause scours. The most serious losses occur with outbreaks of so-called "white scours." The calves develop a severe diarrhea, the discharge being a dirty yellow color, very fluid, frequently frothy, and having an extremely offensive odor. The calf becomes

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weak very quickly, and unless treatment is given, usually dies. In severe outbreaks the calves may even die before diarrhea develops.

While calves may become infected with organisms causing scours before birth, in most cases the infection is obtained by mouth from bacteria on the cow's udder or other parts of her body, or on the litter in the stall. Bacteria will grow rapidly in the digestive tract. The baby calf is a delicate animal and harmful bacteria show their effect quickly.

The use of acidophilus milk as a treatment for scours in calves was originated by Drs. J. N. Shaw and O. H. Muth at the Oregon Agricultural Experiment Station in 1935. It is known that *Lactobacillus Acidophilus* makes up a large and desirable part of the bacterial flora in the digestive tract of normal calves. The giving of acidolphilus milk is an effort to replace or to prevent the development of undesirable bacteria in the digestive tract.

Since the very favorable results from using acidophilus milk in experimental trials, it has been extensively used in the herds of dairymen with excellent success. Calves suffering from typical "white scours" usually recover promptly if treated before the disease has done too much damage. In herds that have had severe outbreaks the administration of acidophilus milk shortly after birth has served as a preventive.

Because of the large demand for acidophilus milk to feed to newborn calves (and lambs), the Dairy Products Laboratory of the Oregon State College has developed a satisfactory method of making, canning, and distributing the milk throughout the Pacific Northwest. Several thousand sealed pint cans are sold annually. The preparation of acidophilus milk requires laboratory care. The milk kept at room temperature in sealed cans gradually decreases in number of bacteria but is satisfactory until about one month of age. The dosage for a calf, easily administered by mouth, is one-half can.

It is believed that if the acidophilus milk treatment for scours in calves were more generally used throughout the country, many thousands of valuable animals would be saved annually.

Nitrogen for Fruit Production

Condensed from California Cultivator

R. E. Stephenson

NITROGEN is the element most often required in additional amounts on many soils for fruit production though by no means the only fertilizer required. The fruit tree absorbs its nitrogen mainly in the form of nitrates. The fine feeding roots are the absorbing organs of the plant. Nitrates and other nutrients absorbed pass from the feeding roots through the larger conducting roots into the tree trunk, out through the branches and finally into the leaves and growing points, where elaboration into the tissue of the plant takes place.

A full grown tree weighing a ton will contain in foliage and branches, about 20 pounds of nitrogen, the amount supplied by 100 pounds of sulphate of ammonia. Nearly a third of the total nitrogen will be found in the foliage. The leaf bud is richer in nitrogen than any other part of the tree except the fruit bud, which contains slightly more; sometimes nearly 4 per cent. Cherry fruit buds have been reported to contain more than 4 per cent of nitrogen, or as much as is found in young clover or alfalfa. The fruit itself when mature contains two to four pounds of nitrogen per ton.

The nitrogen percentage is highest in the young leaf, early in the season just before the bud opens. As the leaf grows to maturity the reserve of nitrogen stored in the tree from the fall before is partially exhausted to meet the needs for the rapid spring growth. The tree roots are constantly absorbing more nitrogen from the soil, if any is available, to help meet the demands of the plant. Early spring fertilization with a nitrogen fertilizer, therefore, may be especially helpful in tiding over this critical growth period. The period just before blossoming is especially important. Liberal application of a nitrogen fertilizer just before blooming may enable weak trees to set a good crop of fruit. Without the nitrogen fertilizer the trees may bloom heavily but set little fruit. Response from the fertilizer may be obtained in two or three weeks after the fertilizer is applied.

The leaves are the laboratories and factories where plant food is manufactured and organized for

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growing new tissue in the tree or fruit. The size and color of leaves is a good guide to the need for fertilizer. For heavy fruit production, bearing spurs must be strong and vigorous. The fruit spur draws on the nitrogen supply stored in other nearby tissue such as the phloem (part of the bark). One-fourth to one-half the stored nitrogen in the bark may be used during the period of shoot growth. Previous nitrogen storage, which may be increased by the use of nitrogen fertilizers the season before, is an important factor in both the fruit set and the early spring growth.

For leaves to function most effectively they must have nutrients, moisture and sunlight. Light increases nitrogen assimilation by furnishing energy for manufacture of sugar and other carbohydrates and for the formation of amino acids, the nitrogen-carrying building stones that go into the formation of proteins. The grower improves his light conditions, perhaps sometimes unknowingly by proper spacing of his trees, somewhat by pruning, and finally by taking out some of the trees in a crowded orchard. Overlapping branches, the evidence of crowding, seldom produce much fruit. Many old orchards are too crowded for satisfactory production.

As the newly set fruit continues to grow, the nitrogen of the fruit spur is partially exhausted. When a heavy crop matures so much nitrogen may go into the fruit tissue that the vegetative parts of the plant are subjected to nitrogen starvation. Or there may not be enough nitrogen to manure the fruit, and small size with many culls is the result.

Finally, when the season's harvest is complete and the leaves begin to age, much of the surplus of nitrogen in the leaves in the form of amino acids, along with the carbyhydrates and some minerals, returns from the leaf to be stored in the branches, trunks and roots of the tree. A long aging period for the leaves before they drop results in more time for storage and more future vitality for the tree. A heavy frost and early leaf fall limits storage and reduces the supply of reserve plant food in the tree to start next year's growth. Shedding of leaves in a drouth period greatly debilitates the tree. Thus the vitality and productive capacity of the tree this year is much influenced by what happened last year.

The amount of nitrogen fertilizer to use in fruit production depends upon the kind of fruit, the age and size of trees, the fertility of the soil and past treatment of the orchard. A neglected and starved orchard will require more than a year, perhaps four

or five years, to recover even under the best of treatment. Trees located on soils that are entirely unsuited will never grow into good orchards under the best of treatment.

The equivalent of 500 pounds of sulphate of ammonia an acre is about the minimum from which a satisfactory response may be expected on trees of good size and in production. As much as the equivalent of 1000 pounds of sulphate of ammonia an acre may be advisable to obtain a quick response from starved trees, and it is necessary to guard against other deficiencies which must be corrected before a nitrogen application will have a chance to take effect. There could be zinc deficiency (little leaf), manganese deficiency, or other nutrient shortages that effectively hold down production. With other deficiencies corrected, followed by liberal nitrogen fertilization, the chances for a satisfactory response in the growth of the tree and ultimately in the harvest, are good.

Early Farrowed Pigs Are Healthier

Condensed from Hog Breeder

G. Bohstedt
University of Wisconsin

A COMMON impression among hogmen is that those spring pigs that have been farrowed earliest are the most thrifty. One might extend this to other livestock and say that the early-born animals seem the more vigorous and, as in the case of early pigs, are more likely to be selected for breeding stock.

Such impressions seem to be borne out by facts, and the writer on speculating over this matter made an appropriate analysis of some of the herds at the University of Wisconsin. Examining the weaning weights at 56 days of age of several hundred litters of pigs farrowed during the 10 years of 1936 to 1945, there was evident a similar better rate of growth by early-farrowed as compared to later-farrowed pigs. Some breeds were found to be more consistent in this respect than others, the Chester White behaving in the following fashion:

Month Farrowed	No. of Litters	Av. Wt. Per Pig at 56 Days, lbs.
February	4	35.9
March	61	30.1
April	102	27.4
May	50	27.6

Reprinted by permission from the Hog Breeder, Chicago, Ill., Oct., 1945

Both sheep and hogs therefore seem to confirm the general observations made by producers and breeders that "the early bird gets the worm," or that the earliest-farrowed pigs somehow are favored by nature or management and enjoy greater vigor, as suggested by these live weights at approximately weaning time. Actually, the weights and appearances of the pigs when pretty well grown, rather than merely weaned, have been more convincing, and the differences in weight at 5 or 6 months of age are more striking, but because of different post-weaning treatments do not lend themselves so well for analysis.

Last summer the writer, while visiting a number of hog farms around the Austin, Minn., area was very much impressed by the outstanding uniformity and growthiness of a herd of market hogs that had been raised off pasture, having been farrowed the previous January. The sows, to be sure, had had the advantage of pasture whenever possible. The owner, an obviously good stockman, indicated that he preferred to have litters come at that time of year since he then had most time to care for them. He showed us the unpretentious quarters where these pigs had been born and reared, and which had plenty of straw insulation, which at the same time absorbed a great deal of moisture, and therefore kept the place dry. No artificial heat was used.

Here we have a rather extreme test of the possible advantage that a pig farrowed very early in the season may have over the late-comers, even though the latter presumably are ushered into a much more comfortable, greater, and happier world.

Might the reason in part be the fact that the early pigs benefit from a better prenatal nutrition, being carried by their dams while still on pasture or but recently off pasture? Might the stored vitamins, minerals, or other good things acquired from the previous pasture season, and permeating the liver and other organs of the sow, accrue to the benefit of the developing litter that is being carried at that time of year?

Soon after the pasture season there would still be a large store of these vitamins, for instance, which during the progress of the winter are progressively used up in the body system to the extent that during February and March the sow is more and more depleted, and the intra-uterine nutrition of the developing litter is far from ideal. And let us not lose sight of the fact that a sow well stocked with a reserve of carotene, B-complex vitamins, and still other necessary nutrients, is

in better condition to produce milk and to nurse her litter after it is born. In other words, the young that are born of dams well stocked with the invisible food reserves, the minerals and vitamins, are getting a better start in life.

The dam of an animal to be born during the winter or spring is progressively in a worse condition to take care of the nutritional needs of the unborn young. That is, unless the dam should be fed rations that include as much as possible the nutritive properties of green grass or pasture. One may here think of leafy green alfalfa or other hay—also protein concentrates from animal source, such as skimmilk, buttermilk, meat scraps, tankage, fish meal, and the like.

One may ask whether, in addition to the pre-farrowing nutrition of the young, there might not be other factors that play a part in the apparently greater vigor of early-born as compared with late-born pigs. Such a question is entirely logical. One might, for instance, point out that very likely the most vigorous or oldest sows conceive first in the fall of the year. One might further wonder whether, during cold weather, the parasite and disease problem might not be greatly reduced, these organisms being perhaps in a dormant stage and not so likely to infest or infect the susceptible young animal. But when warm weather or spring starts in, life of all sorts, not merely green grass but also stomach worms, roundworms, and their like, start life anew, and are ready to pounce on their susceptible hosts, the young animals. These, however, in the case of the early-born and therefore well-grown animals are much more resistant to the invasion and to the havoc produced by these parasites.

At any rate, an interesting question here poses itself to producers and breeders, and it would seem that some controlled experimental work might be done in this direction, which might separate some of these factors and put the spotlight on one or the other. We know enough about pasture, however, that is, clean pasture, to appreciate that green growing grass recharges the system of all livestock with health-giving nutrients which are supposed to last until the beginning of another pasture season. Unless winter rations are better than ordinary, however, these nutrients may not last long enough. The nourishment of the unborn young then becomes poorer and poorer toward the end of winter, thus probably accounting for the less satisfactory thrift on the part of late-born animals.

Fertility Rises in Ungrazed Grassland But Pastures Must Be Carefully Managed

Condensed from Science for the Farmer

J. W. White

THOUSANDS of Pennsylvania farms, cleared and put into production since the Civil War, have been abandoned because of loss of fertility. Sod protects the soil; in fact, repeated tests have shown that fertility slowly but surely rises in ungrazed grassland.

It is unreasonable to suppose, however, that if hay and pasture crops had been grown more extensively on these farms that many would be producing today. Poorly producing pastures are common if not the general rule. A pasture requires careful fertilization and management for maximum grazing yields. A review of experimental work over an extended period is necessary to show how grass may be used in the maintenance of soil fertility.

In 1867 an area on the Station farm at State College, Pennsylvania, was seeded to timothy and clover. This land already had been devoted to general farming for about 30 years. Two years later plots for miscellaneous experiments were laid out in this field. In 1881 these plots became the General Fertilizer series, a name which later was changed to the Jordan Fertility Experiments. Half of the Jordan plots still remain, in which the 2-foot grass division strips and 12-foot roadways have been undisturbed since the original seeding. At no time since 1867 have these division strips and roadways received any fertilization except that which may have blown over or washed over by accident.

The Jordan plots have been under a typical Pennsylvania 4-year grain rotation of corn, oats, wheat, and mixed hay since their establishment. Five fertilizer treatments applied on the corn and wheat and duplicated in four tiers are of interest in this discussion. They are: (1) Unfertilized, (2) PK (48 pounds of phosphoric acid and 100 pounds of potassium oxide per acre), (3) PKN (PK plus 48 and 72 pounds of nitrogen from nitrate of soda per acre), (4) 6 tons of manure

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on limed land, and (5) 10 tons of manure on unlimed land. Two of the four tiers of plots were limed from time to time to correct soil acidity.

Fertility of division strips—The unfertilized check plots are an example of farming with no thought of care for the soil. The only reason why these plots are producing at all probably is because they are on Hagerstown silt loam, a soil which is of limestone origin and naturally one of the most fertile in this region. Land of most soil types which has been so thoroughly misused as this may be able to support only the coarsest and hardiest grasses and weeds. Even in such areas, as often has been noted, the soil fertility slowly improves and more nutritious grasses creep in if erosion is not too severe. Natural processes of restoration take ages, but stands of grass may be obtained more rapidly in most cases through applications of manure, lime and mineral fertilizers.

At the end of 72 years, the fertility levels of the grassed division strips and roadways and the plot soils of the Jordan plots presented a remarkable contrast. The unfertilized grassland soils showed a nitrogen level 68 per cent above the unfertilized plot soil, 40 per cent above the PK treatment, 42 per cent above the NPK, 19 per cent above the soil treated with 6 tons of manure, and almost 12 per cent above that treated with 10 tons of manure.

Nitrogen and organic matter contents are accepted measures of fertility although soils often require other amendments to improve their productivity.

The grassed roadway soils of tier 4 maintained a nitrogen level 20 per cent higher than the plot soil which received biennally 10 tons of manure and a level about 73 per cent above the average of the five unfertilized plots.

These results rather conclusively prove the difficulty of maintaining soil fertility in cultivated land as high as that in permanent grass; such heavy applcations as 10 tons of manure every 2 years rarely are possible on Pennsylvania farms. It should be noted also that these grass strips and roadways were not subject to erosion to the same degree as pastures but the 2-foot borders probably dried out more in summer. The grass in them, largely bluegrass with occasional patches of White Dutch clover, was mowed on the average of twice per season for hay.

Fixation of nitrogen—Approximately the same nitrogen level was maintained in the plot soils which did not receive heavy applications of nitrogen as in those which did. On the two unlimed tiers, the NPK treated soils were

only 4.8 per cent higher in nitrogen than the PK treated plots, and in the limed tiers the advantage was slightly less. This fact together with the high nitrogen content of the untreated grassland serves to emphasize the importance of nitrogen fixation by common soil bacteria.

This fixation of nitrogen from the air was the result of the activities of clostridia, a common non-symbiotic organism. This bacterium, in contrast to azotobacter which may accompany it, grows in the absence of air, will thrive in more acid soil, and does not require the presence of a legume.

Fixation of atmospheric nitrogen depends upon the presence of liberal amounts of organic residues as a source of bacterial energy. For this reason, nitrates follow the trend of organic matter in the soil. Tillage hastens the decay of dead plant material and if organic matter is allowed to decline, production of nitrates is correspondingly slowed.

Other research men have shown that a legume such as clover when cut and removed for hay adds no nitrogen to the soil, the additional nitrogen produced by azotobacter, a non-symbiotic organism, being removed in the hay. Increased yields of crops following clover result from the rapid release of nitrates from the decaying clover roots and the presence of large amounts of organic matter. Continuously grazed pastures are depleted in the same manner as continuously cropped fields. Adequate supplies of plant food to maintain a thrifty sod must be present at all times.

Grass is subject to a multitude of uses. It may be grown for purely decorative purposes, to supply feed for livestock, to improve soil fertility, or, as on most farms, to fill a combination of these and other needs. A farmer with a "worn out" pasture can't wait for 50 to 75 years, as was done with the Jordan plots, to determine if it is going to improve itself. On the other hand, he may find it necessary to use some of his best land for grazing.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUG. 24, 1912, AND MARCH 3, 1933

of the Farmers Digest, published 11 issues a year at Ambler, Penna. for October 1, 1945

State of Pennsylvania
County of Montgomery } ss

Before me, a Notary Public in and for the State and County aforesaid, personally appeared A.E.Heick, who, having been duly sworn according to law, deposes and says that he is the busines manager of the Farmers Digest and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor and business manager are: Publisher, L. Bush-Brown, Ambler, Pa.; editor, L. Bush-Brown, Ambler, Pa.; assistant editor, C. Leavitt Dyer, Baltimore, Maryland; business manager, A. E. Heick, Ambler, Pa. 2. That the owners are: L. Bush-Brown, Ambler, Penna.; C. Leavitt Dyer, Baltimore, Md.; A. E. Heick, Ambler, Penna.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: none. Signed, A. E. Heick, Business Manager.

Sworn to and subscribed before me this 13th day of October, 1945 (Seal). Mary C. Cassidy, Notary Public. [My commission expires May 1, 1948.]

Prepared vs. Long Hay

Condensed from Southern Agriculturist

Dr. J. W. Rupel

Dairy Department, University of Wisconsin

THERE is no magic in chopping or grinding hay. The feeding value of good quality roughage is not improved by grinding or chopping. Only when the quality is so poor or when the roughage is so coarse that considerable amounts are refused when fed unchopped, is there any improvement in feeding value by chopping the hay. In three experimental trials at the Wisconsin Experiment Station there was no benefit received from chopping a good quality of alfalfa hay for dairy cows. On the other hand, chopping soybean hay (which the cows refused to the extent of 18.4% when fed whole (increased the value from $15 per ton to $17.91—a 19.4% gain. At the South Carolina Experiment Station, grinding alfalfa hay for dairy cows was found to be worth 59 cents per ton, soybean hay $3.23, and oats and vetch hay eight cents per ton.

The cost of chopping hay varies with the cost of power, labor, machinery, the condition of the hay, and the fineness to which it is chopped or ground. When all costs are included the charge may range from $2 to $3 per ton under farm conditions. Under conditions of high roughage prices or of great scarcity, some saving may be made by chopping the coarser roughages. About all that is gained by chopping is to get the stock to eat the 50 to 300 pounds of coarse stemmy material that they would otherwise refuse from each ton of hay fed. Experimental trials have failed to show that chopping or grinding improves the digestibility of the hay eaten, and in some instances finely ground roughage showed slightly lowered digestibility.

Some stockmen prefer to feed long hay, claiming that cattle appear better filled when consuming it than when the same amount of chopped hay is fed. Some dairymen believe that young calves will learn to eat hay more quickly when long rather than chopped hay is fed. Sore mouths in horses and sheep have been reported as due to the irritation from the sharp pieces resulting when dry,

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lard-stemmed hay has been chopped and fed.

The dust produced in chopping r grinding hay is a nuisance to both man and beast. In addition to the dust, finely-ground or chopped hay or other roughage for horses may be a cause of colic nd indigestion.

Aside from the experimental findings regarding the feeding value of chopped hay, it may have some advantages in that it can be handled more easily and fed with less waste. When fed in racks, long hay is often pulled out and trampled by the stock. Chopping reduces such losses considerably.

Practical farmers ask whether by grinding roughage and mixing ground grain with it, the ration may not be improved. Ample experimental work on this point has shown that even where slight improvement was obtained in the rate of gains made by fattening cattle and lambs, the practice was not economical since the cost of preparation equalled or exceeded the returns from it. It has been shown, however, in experiments at the Wisconsin Station that feeder lambs may be gotten on feed more safely by mixing grain with chopped hay. Western lambs were safely self-fed a mixture of ⅓ cracked barley and ⅔ chopped alfalfa (by weight) almost from the day of arrival; later the mixture was changed to equal parts of grain and hay.

The development of machinery to pick up hay in the field, chop it and blow it into the mow, offers certain labor-saving advantages in harvesting and storing the crop. Chopped hay may be stored in less cubic space per ton. This increases mow capacity and likewise the weight of stored feed that may be placed in a given barn. Certain two-story barns have actually broken down after they were filled with chopped hay. If there is any doubt about the strength of supporting structures, a check with an agricultural engineer should be made to see that they are adequate.

One should consider the purchase of hay chopping equipment from the angle of the labor it may save in harvesting and storing the crop rather than by placing undue emphasis upon the improvement in feeding value through chopping. It is definitely to the advantage of every farmer to produce high-quality roughages for his livestock and it will seldom pay to grind or chop them. Efforts are now being made to devise machines that will chop hay only fine enough for machine handling and will leave it as nearly like long hay as possible.

Wheat Pasture Needs Help

Condensed from Kansas Farmer

VALUE of wheat pasture as a crop in its own right is widely accepted in Central and Western Kansas. But many operators believe wheat pasture, without some kind of supplementary feeding, does not bring maximum results. Because of the varying quality of wheat pasture by areas and by seasons, and because of uncertain weather conditions, depending on it alone for livestock gains is extremely risky. It does not permit full utilization of feed resources in the area, say experienced livestock men.

Wheat pasture under ideal conditions will produce phenomenal gains at little cost. This is indicated by tests at the Fort Hays Experiment Station. Yearling steers there have gained 252 pounds in 150 days on 1½ acres of wheat. That is an average of 175 pounds an acre. However, these steers had access to dry feed at all times, and to cottonseed cake when the wheat was covered with snow.

There are some who still will not pasture wheat because they believe it will reduce yields. But on the basis of 5 years of experiments at Hays, it was proved definitely that on the average moderate pasturing of wheat, from October 15 to not later than April 15, did not reduce yields. In a 5-year test on summer-fallow land, wheat yields were increased 2.3 bushels an acre on land moderately grazed, in comparison with check plots not grazed. On continuous-cropped land, however, the yield on grazed land was 1.2 bushels an acre lower than where not grazed.

The dangerous part of the wheat-pasture program, says John P. Perrier, Ford county agent, is that too many farmers are not yet convinced of two things: that they should have a reserve supply of feed to take them over periods of bad weather; or that something else should be fed supplementary to the wheat pasture for full utilization of feed and for maximum gains. Using silage as a supplement to wheat pasture, and silage and protein when pasture is not available, would do more than anything else to stabilize the cattle industry in Western Kansas, says Mr. Perrier.

Farmers in that area who have experimented with supplementary feeding with wheat pasture are thoroly convinced of its sound-

Reprinted by permission from the Kansas Farmer, Topeka, Kansas, Aug. 4, 1945

ness. But all do not agree on the type of feed that will bring the cheapest and best results.

Long-time experiments at the Hays station have proved that cattle will do as well on silage and protein feed as they do on wheat pasture. And that this combination makes a wonderful feed to carry them thru stormy weather.

Silage can be utilized in winters when there is no wheat pasture for cattle, thus allowing a farmer to handle some cattle every year.

Experiments at Hays also show that twice as much feed an acre is possible when fed as silage rather than in a dry form. Relative feeding values as found at Hays are as follows: Kafir hay, 355.5 pounds of beef an acre; cane hay, 281.7 pounds of beef; kafir fodder, 233.80 pounds of beef; cane fodder, 309.40 pounds of beef; kafir silage, 524.58 pounds of beef; cane silage, 605.80 pounds of beef to the acre.

More experiments, both by farmers and by Kansas State College, are needed to determine the true value of wheat pasture and supplementary rations to stabilize cattle production in Central and Western Kansas. But with knowledge already gained, the future looks extremely bright.

Fire — Servant or Master?

Condensed from The Michigan Farmer

L. C. Meyer
REA Safety Supervisor

MAN'S first encounter with fire was probably either that of a forest fire kindled by lightning or an erupting volcano. It is little wonder then that this destructive and devastating fury should be accorded supernatural origin and regarded with reverence and awe. Since that time, man has learned how to apply and direct fire and has made varied application of it in advancing to the civilization of today. It is doubtful if we are more dependent on any one item, other than water or air.

Without fire, there could be no iron or steel or the thousands of articles of which they are made. Fire is used in the creation of glass, the manufacture of rubber and hundreds of other items. When applied to water, it creates steam which drives locomotives. It makes electricity by means of the steam turbine and the generator. By means of steam engines, it puts into motion thou-

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sands of machines which shape, weave, process, convert and prepare most of the articles which we use in our everyday life.

That we have not gained complete control of fire is evidenced by the enormous destruction of life and property each year. At one minute, fire is a blessing and a valued servant. The next, it is a ruthless destroyer. It is no respecter of persons, places or things.

Fires are spectacular, but unless the loss of life or destruction of property is exceedingly great, they usually pass unnoticed except for the immediate neighborhood. Nevertheless, fire consumes at the rate of more than a home a minute throughout the year. A picture of the nation's fire losses can be had in the following paragraph from an address delivered at a fire prevention meeting:

"The buildings burned, if placed on lots of 50 foot frontage, would line both sides of a street extending from New York to San Francisco. A person journeying along this street of desolation would pass in every quarter of a mile a ruin from which an injured person was taken. At every third of a mile on this journey he would encounter the charred remains of a human being who had been burned to death."

The death toll from fire last year was approximately 10,000, a third of which were children under 10. The value of property destroyed was well over $400,000,000. Farm fires alone account for slightly more than a third of these staggering totals.

Most fires, like accidents, have definite causes. If these known causes of farm fires can be eliminated or avoided, a great reduction in fire losses will immediately result. Fully a third of rural dwelling fires are due to defective chimneys and flues. Sparks on the roof account for an additional one-fourth of the total. Thus the daily needs of cooking and heating account for over half of the total fire losses. Other causes which involve all farm buildings are: (1) lightning; (2) careless use of matches and smoking; (3) improper use of gasoline and kerosene; (4) hot ashes and coals, including open fires; (5) spontaneous ignition; and (6) misuse of electricity.

Everyone should investigate these fire possibilities.

Before cold weather sets in inspect your heating system. Clean all smoke pipes and chimneys. See that the smoke pipes are secure and that they have not rusted through during the summer months. See that no cracks have developed in the chimney, especially where it goes through the attic. Put your heating plant in

good condition and keep it that way. Have a long ladder handy in case of a roof fire, and when you remodel, install a fire-proof roof.

Don't neglect to clean the attic and basement of papers, magazines, empty boxes and other trash that may have accumulated. One fire preventionist stated that a large percentage of residence fires could be avoided by simply cleaning out the attic. In order for fire to make headway, it must have continuous supply of combustible material. Keep this type of material away from fire and you have eliminated a lot of fire possibilities.

Lightning is listed as the second greatest cause of farm fires and probably heads the list of causes for barn fires. While there is no known means of preventing lightning from striking your buildings, a properly installed set of lightning rods will conduct these powerful discharges safely to ground. See that the cables running down from the roof maintain permanent connection with moist earth.

Careless use of matches and smoking is also high on the list of causes. Smoking in barns and outbuildings should be prohibited. If matches must be carried, a "safety" match is to be preferred to the "strike anywhere" variety, and it's a good practice to break a match before throwing it away. Use caution in selecting a place to lay or to discard a cigarette. Just one cigarette started a 2 million dollar fire during the first World War.

Improper use and storage of gasoline and kerosene has started a lot of disastrous fires also. Never use either for starting a fire or to speed up a slow one. Home dry cleaning indoors with gasoline or benzine collects a large annual toll of victims, while improper storage of gasoline in barns, sheds, or near other buildings has contributed to fires causing greater damage than would other wise have resulted.

Never place hot ashes in combustible containers or pile them against wooden partitions. When burning leaves, brush or rubbish out of doors, make certain every spark is out before leaving it. Embers have been known to remain alive for 72 hours when blanketed with ashes. A recent rural dwelling fire which claimed 3 lives, started from a rubbish fire which had been left. In the dead of night, wind caused it to spread through dry grass to the back of the house which soon became a blazing inferno.

Misuse of electricity causes its share of fires. We should not blame the electricity for this, but the person who placed the extension cord under the rug, the penny or washer behind the fuse,

or made the improper and unsafe installation or extension of the wiring. Proper installation and handling of electrical equipment will not only reduce fires but prevent the severe and often fatal burns and shocks which occur when accidental contact is made with energized electrical equipment.

Spontaneous ignition of oil and paint covered cloths occasionally is responsible for a dwelling fire. The bursting into flame of hay or fodder which had been stored with too high a moisture content, another example of spontaneous ignition, ranks second as a cause of barn fires. Keep the barn roof in good condition because hay that has become damp from rain leaking on it through a hole in the roof will spontaneously ignite just as readily as hay that was damp when hauled in.

There are other causes of farm fires, such as power machinery, incubators and brooders, and of course lamps and lanterns which further extension of rural power lines will almost completely eliminate.

One reason for the large percentage of total loss in rural fires is the distance from adequate fire fighting equipment, and usually an inadequate supply of water handicaps the fire department when it does arrive.

A recent survey of a mid-western state discloses that the total property damage to buildings in cities which caught fire was only 5% of the value of the property involved, while in rural areas, the total damage averaged 74% of the value of the property which caught fire.

In view of the great loss of life in rural fires, every farm family should sit down and discuss what each member of the family should do in case fire did break out. In many cases a fire can quickly block the only exit to an upstairs, and tragedy will result unless prompt and proper action is immediately taken.

The best way to put out a fire is to prevent it from starting. This is one place where such old sayings as "a stitch in time saves 9" and "an ounce of prevention is worth a pound of cure" really pay big dividends.

You know most of the causes of fire which might cause complete destruction of your farm buildings. Fire Prevention Week is here again to remind you of them, and to urge you to clean up, fix up, and remove and repair until all the fire hazards you can locate are well taken care of. Make every week a fire prevention week on your farm. Never permit a fire hazard to exist and you will have made the destruction of your buildings by fire a remote possibility.

Better Balance Gets Results

Condensed from Turkey World

Geo. P. McCarthy

WHAT is a "balanced" turkey? This question is, no doubt, asked by many interested producers. For "balance" a turkey must have proper distribution of weight upon the legs which serve as the axis. The legs must be attached far enough to the front to give proper distribution to the weight of the bird. With proper distribution of the weight, there is less muscular strain upon the legs, affording freedom of movement.

When the legs are attached too far to the rear, the reverse takes place. The leg muscles are unable to satisfactorily handle the added weight in the front and a drooped appearance is observed. This is referred to as "front heavy." Unbalanced toms are not active due to muscular strain and consequently spend a major portion of their time sitting down. Such toms are not active in the breeding pens and are slow in mating. Because of the extra front weight, it is very difficult for them to properly mate. Their awkwardness often results in back injuries to hens and refusal of many hens to mate. Resulting low fertility handicapped many breeders of Broad Breast Bronze.

Criticism cannot be directed at Broad Breast Bronze breeders for the lack of balance in the early strains of breeding birds. It was impossible to get "all the eggs in one basket" and in an effort to put more breast meat on the birds, carriage and balance were secondary. The dressed shows emphasized the breast development to further encourage the breeding of front heavy individuals.

There was considerable difference of opinion among breeders on selection which made it even more confusing to know just what was right and proper. The breast selection held the spotlight and balance, or the amount of strain the legs could take, was secondary.

Many weak legs and breeding pen breakdowns were the result of severe muscular strain. The strain on the leg muscles by toms attempting to counter-balance the extreme weight of breast was severe. Many a breeder shook his

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head at a tom and thought to himself, "he's an excellent sitter, but a darn poor breeder."

The problem of poor hatches was a constant source of worry to breeders. A few of these individuals decided to do some trap nesting and progeny testing breeding to see if they might not find a partial answer to this problem. This work was started in 1940. Their first year's production records and hatch records showed outstanding results, in certain individuals, while others gave very disappointing results.

In 1941 Dr. J. N. Thompson of the Texas Agricultural Experiment Station emphasized the importance of "Balance" in selection to improve mating and consequently increase fertility. The breeders immediately put this theory into practice and found it had merit. By taking their best individuals from their pedigreed stock and checking very closely for balance they have been able not only to improve their fertility and hatchability but also production. This meant more poults per hen which was a program the breeder and hatcheryman wanted.

The breeders today are very critical of their turkeys that go in breeding pens or any that are sold for breeders. They must stand a very rigid physical examination and the final one must be "it has balance." The hens and toms are all walked, and any individual that has a tendency to be front-heavy goes to market. If a tom does not walk erectly enough to where his shoulders are above the level of his hip, he is considered undesirable for a breeder. In addition to the front heavy check, all individuals must have strong legs and free of any weakness, such as weak knees, knock knees, bow legs, small weak thighs, extremely short legs, or crippled or deformed feet. The legs and feet must be good and must be strong.

The pedigree breeding and selection for balance have paid dividends for Texas breeders and commercial egg producers through better fertility and higher hatchability. One large commercial egg producer reporting on his flock of 1,400 Broad Breast Bronze breeding hens stated, "My hens produced an average of slightly better than 70 eggs per hen. My fertility ran as high as 92 per cent and did not get below 80 per cent at any time that I know of." Another commercial producer of 1,000 Broad Breast Bronze hens credits the use of ROP toms with increasing his fertility 10 per cent from the 1943 to 1944 season. One large commercial turkey hatchery man reported, "I can safely say that from the 65,000 to 70,000 turkeys produced in my territory 75 per cent will run Broad Breast

Bronze and approximately 60 per cent are using certified or ROP Toms. My record for last year on turkey eggs hatched in my machines averaged 72 per cent on all eggs set." These are only a few of the reports from commercial producers and were used to illustrate the point that the use of balanced breeders has resulted in greater fertility and more poults.

A check into the records of the ROP breeders illustrates these points even better. One breeder, we will call A, has been doing trap nest and selective breeding for five years. On 100 trap nest breeders the season production was 70 per cent, fertility 93 per cent and hatch of fertile eggs 96 per cent. While on the commercial flock of approximately 500 hens, the production was 60 per cent, fertility 87 per cent and hatch of fertile eggs 90 per cent. This particular breeder was very discouraged the first two seasons because of low fertility and hatchability, but the use of "balanced" toms from selective breeding is largely responsible for the excellent records of the past season.

Breeder B, a large operator doing official ROP work, produces records that convince even the most skeptical of the importance of individual pedigree and selection for balance to produce eggs that will hatch. For example, Tom A was from a hen of high production and fertility and was of excellent balance. He was mated to 15 hens, five of which had 100 per cent fertility, five better than 90 per cent fertility and the balance in the 80's. The lowest hatch of all eggs set was 72 per cent; the highest 94 per cent. Tom B, with good dam record and of excellent balance, sired 15 hens of which six were above 90 per cent and the balance above 80 per cent. A check through 21 pedigree pens brings out the same startling results that where outstanding individuals of known production ancestry were used and the individuals carefully selected for balance, high production, fertility and hatchability resulted.

The turkey industry can well afford to be proud of the wonderful progress that has been made in breeding work during the past 10 or 12 years. A truly great market turkey was developed to meet the demands of the housewives. The breeders since have concentrated on how to produce the most poults per hen and do it efficiently. Selective breeding and "balance" seem to be the best answer.

Feeding Work Stock in Winter

Condensed from The Southern Planter

Jos. M. Vial
University of Maryland

THERE is an old truth handed down through the centuries by the ancient Arabs that fat and idleness are the chief enemies of the horse. We can all vouch for the soundness of this statement. That is why winter feeding of our work stock should concern all of us.

Before attempting to feed the farm work stock through the winter, money is usually saved by an annual check-up on the condition of the teeth of these animals. The intake valves of your tractor waste fuel if not properly seated. The horse that cannot masticate his feed properly also wastes the fuel that keeps his motor running. If needing attention, have the horse's teeth floated by a competent individual.

Have the manure from each horse examined for parasite infestation. If found heavily infested, it is good economy to rid the animal of internal parasites. Then don't overlook the external parasites, such as lice. They cause a lot of discomfort and a beast just doesn't do well if harboring them.

Any veterinarian can make the examination of the manure and advise the kind of treatment needed. We have been experimenting at the University of Maryland with the use of a phenothiazine-salt mixture (1 to 15) for the control of worms in young equine stock. The results have been satisfactory, but we are not yet ready to advocate this method as a general farm practice.

For external parasites, a sheep dip wash is advised in good weather, or a commercial lice powder in the winter months when temperatures are low.

On most farms, our work stock is subjected to heavy peak loads during the crop season and then to complete or partial idleness at other times. It is comparatively easy to keep a team in the pink of condition if that team has to look through the collar all day, every work day of the year. It is quite another undertaking to keep teams fit due to the irregularity of the farm work. Most farm horses or mules average less than 90 ten-hour days a year in the collar. Many farm teams do not turn a wheel from Thanksgiving until

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spring work commences. They probably closed the season thin in flesh, hence the owner wishes to build them up during the idle winter period. All too often his good intentions are ruinous to the horse. The owner is prone to stable him too much, forgetting that the horse is an outdoor animal. He usually feeds too heavily on grain that is not needed for body maintenance. He frequently is careless of the horse's water and salt needs.

But, in spite of the owner's treatment, the horse may gain in flesh, but be a less efficient power unit the following year. Hence there are a few factors to stress in connection with the winter feeding of our idle stock just as vital as roughage and certainly a lot more necessary than grain. They are regularity, sunshine, fresh air, exercise and water. Even though salt is added to the five factors listed, the cost, up to this point, is nominal.

Roughages should constitute the greater part of the ration itself, or more properly speaking, forages. The cheapest means of supplying these forages during the late fall and a great part of the winter, would be to give the work stock access to the fields and pastures. They can obtain a lot of their ration by gathering the aftermath, grazing fence rows, and meadows. In the process, if given the freedom of the fields, the five factors mentioned as being essential to his well being and happiness will not be neglected. Coarse roughages such as corn fodder and straw can be supplied in the barnyard or fields at little expenditure of labor. Roughages will reduce the winter feed costs.

Care must be taken with young colts and breeding stock to guard against the lack of protein, minerals and vitamins. An easy way to insure against such a deficiency is to provide two or three feeds per week of good legume hay. A simple mineral mixture of raw ground limestone, steamed bone meal and salt, kept where the stock has access to it, but protected from the weather, provides the minerals most apt to be lacking. In rare instances, some protein supplement such as bran, oilmeal or the like will be necessary.

Grain need not be fed the idle work stock, except in rare instances, until shortly before spring work begins. Then it is wise to start graining them lightly and working them accordingly to harden them for the heavier tasks to come.

As the work increases, more grain will be necessary. The hay may be reduced somewhat and the quality of all feeds should be stressed when the horse is engaged in work.

Hog Feeding Facts

Condensed from The Dakota Farmer

G. Bohstedt

Professor, Division of Animal Husbandry, University of Wisconsin

THE feed requirements of hogs are to eat enough of the right kind of feed. That seems simple enough. Since grandfather's day, many swine growers have been feeding skimmilk or other dairy by-products along with corn or other grain, and the hogs usually have done very well, especially if they also had a chance to run on pasture.

Corn is the king of feed crops, and it has seemed at times as if corn was about the only feed necessary to make hogs out of pigs. However, even years ago it was found that if young, growing pigs, when shut up in a pen, were fed corn only, they were stunted in their growth. It has actually been possible to kill small pigs on corn alone.

Frequently the run of the barnyards and particularly the run of a good hog pasture would be enough to have hogs, that presumably were fed corn alone, do rather well. With reference to spring pigs, then, that were running at large, their feed requirements were rather simple, but it was different with fall pigs. After all, snow and ice did not balance a ration of corn very well.

Where, in earlier years, we had plenty of skimmilk or buttermilk, also tankage and meat scraps; these protein supplements of animal source are not quite as available now as they were then, and soybean oilmeal, linseed meal, or other protein concentrates from plant sources are of necessity used more and more in swine rations. This development has brought on nutritional problems, and is responsible for some of the swine deficiency diseases that we meet on many farms. We have come to learn that skimmilk or tankage did not merely supply the necessary protein, but also supplied efficient minerals and vitamins, at least a large number of them. Seeds or their by-products, and that includes the whole list of grains, oilmeals, and mill feeds, while excellent so far as they go, have nevertheless a number of serious deficiencies, primarily in reference to minerals and vitamins, and to a less extent to the quality of their protein.

Seeds and their by-products

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have serious vitamin deficiencies, especially carotene, which is provitamin A, and vitamin D, the rickets-preventing vitamin. There is now under way a great deal of research work which aims to find out the deficiencies of the so-called B-complex vitamins in swine rations that are balanced with mill feeds and oilmeals. Rations of that sort, fed to gilts, will never develop them into useful brood sows. There will be failure in reproduction, whether in the vigor or health of the pigs at birth or in the quantity or quality of the sows' milk which is expected to nourish the pigs successfully to weaning age. A long list, some 8 or 10, of the B-complex or water-soluble vitamins are being experimented with, to learn something about the kinds and quantities of these vitamins necessary to be added to mill feed and oilmeal supplemented rations, especially when intended for breeding stock.

In this way are fed the pure or nearly pure vitamins, or concentrations of these vitamins by way of liver preparation, including commercial liver meal, by-products of the soybean industry, and the milling, distilling, and brewing industries. Here we have brewers' yeast, corn distillers' dried solubles, and soybean lecithin, and still other materials that represent certain concentrations of the B-complex vitamins. When combinations of such materials are fed with dry-lot rations from plant or vegetable sources, good reproduction has been obtained, provided the necessary carotene or vitamin A, and also vitamin D, were supplied. The latter two vitamins are present in large amounts in fish liver oils. Irradiated yeast is extremely rich in vitamin D. Incidentally, in the recovery of fish oils that are rich in vitamin A, or both vitamins A and D, there is also a considerable recovery of some of the B-complex in the fish press water which in a condensed state is being used successfully in experimental work, and which may possibly be used in practical rations for both pigs and poultry.

But don't let us suppose that we must necessarily look to all of these strange and somewhat forbidding compounds for success in feeding hogs. In most cases we have, right on the home farm, most of these things that have successfully raised hogs for us all along. In other words, right on the farm we are raising not merely most or all of the necessary carbohydrates, proteins, and minerals, but also vitamins, which if bought in capsules or bottles would cost us a tidy sum of money. So it is reassuring to know that by using at least in large part our home-grown feeds,

including pasture in the summer, and leafy green hay in the winter, together with additional necessary protein concentrates by way of mill feeds, oilmeals, and small amounts of animal by-products, excellent results have been obtained with both fattening and breeding stock. Surprisingly simple mineral mixtures, made up of ground limestone and salt, or iodized salt, at most including a little bonemeal, have been found satisfactory. The run of cattle yards and access to cattle manure has helped provide pigs with certain necessary vitamins long before any of us knew anything about vitamins.

It is helpful, however, to know what nutrients hogs actually need for most rapid and profitable growth and for raising large, thrifty litters of pigs. By thoroughly understanding these requirements we can then supply them by the most practical means at our disposal. Let us, therefore, not forget that leafy green roughages, especially good hog pasture, provide vitamins along with proteins and minerals, which vitamins would come very high at the drugstore.

Let us also be aware of the fact that a brood sow stores within her system many of the vitamins, as well as other nutrients, against the day of need, that is, when she is called upon to deliver a litter of pigs and to nurse that litter to weaning age. A brood sow, with respect to her feed, does not live and thrive merely from day to day, but from one 3 or 4-month period to another 3 or 4-month period. By this I mean to recognize the so-called storage factor which may explain why so frequently pigs born in February or March are thriftier than those born in April or May. The earlier pigs were farrowed by sows that were but recently on pasture, and had a chance to "store up" so many of the fine nutritional principles that benefited their unborn young; whereas sows bred for late farrowing had already used up most of those stored nutrients in their system.

In the degree that we understand nature's ways and are mindful of them in our swine management, are we likely to succeed in this important farm enterprise.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees — By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. (1943). $2.00.

America's Garden Book — By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons $3.50.

An Agricultural Testament—By Sir Albert Howard, C.I.E., M.A., former Director, Institute of Plant Industry, Indore. Oxford University Press. $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean of the School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beef Cattle — By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State Coll., Univ. of Minn., Mont. State Univ. College Book Company. $3.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.00

Dairy Science — By W. E. Petersen, Ph.D., Assoc. Prof. and Assoc. Dairy Husbandryman, Univ. of Minn. Edited by R. W. Gregory. J. B. Lippincott Company. $4.00.

Diseases and Parasites of Poultry — By Edgar Hugh Barger, D.V.M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition (1943). $3.75.

Farm Records — By John A. Hopkins, Ph.D., Asso. Prof. of Economics, Iowa State College. Iowa State College Press. $2.50.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Management and Marketing — By V. B. Hart, M. C. Bond, L. C. Cunningham, all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. $2.75.

Farmers of the World — The Development of Agricultural Extension — Edited by Edmund deS. Brunner, Irwin T. Sanders, and Douglas Ensminger. Columbia University Press. 1945. $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Grow Your Own Fruit—By M. G. Kains, formerly with U. S. Dept. of Agriculture; Professor of Horticulture, Pennsylvania State College. Charles Scribner's Sons. $3.50.

Growing Tree and Small Fruits—By H. B. Knapp, Director, State Institute of Applied Agriculture, Farmingdale, Long Island, N. Y., and E. C. Auchter, Chief, Bureau of Plant Industry, U. S. D. A. John Wiley & Sons. $2.75.

How to Raise Rabbits for Food and Fur — By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. (1943). $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Production—By Walter H. Peters, Chief of the Division of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $3.50.

Livestock Judging Handbook — By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Modern Agricultural Mathematics — By Maurice Nadler, B.S., A.M. Dept. of Mathematics, Newtown High School, Long Island. Orange Judd Publishing Co., Inc. (1942). $2.00.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox, Ph.D., Agricultural Writer, formerly with U. S. Dept. of Agriculture. Orange Judd Publishing Co., Inc. (1944). $4.50.

Natural Principles of Land Use—By Edward H. Graham,, Chief of the Biology Division of the Soil Conservation Service. Oxford University Press. 275 pages. $3.50.

Palestine, Land of Promise—By Walter Clay Lowdermilk, Asst. Chief Soil Conservation Service. Harper & Brothers. 1945. $2.50.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Practical Farming for the South — By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of North Carolina Press. $2.50

Profitable Poultry Keeping — By H. Clyde Knandel, Prof. and Head, Dept. of Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue University. The Interstate Printers & Publishers. $1.80.

Seaman A. Knapp—Schoolmaster of American Agriculture—By Joseph C. Bailey, Dept. History and Social Science, Hunter College. Columbia University Press. 1945. $3.25.

Successful Poultry Management — By Morley A. Jull, Professor and Head of Poultry Dept., University of Maryland. McGraw-Hill Book Company. $3.00.

The American Land—Its History and Its Uses — By William R. Van Dersal, biologist in the United States Department of Agriculture. Oxford University Press. $3.75.

Successful Poultry Management—By Morley A. Jull, Professor and Head of Poultry Dept., Univ. of Maryland. McGraw-Hill Book Co., Inc. $3.00.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Soil Conservation — By Hugh Hammond Bennett. Chief, Soil Conservation Service, U. S. Dept. of Agric. McGraw-Hill Book Co., Inc. $6.00.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

Weeds of Lawn and Garden — By John M. Fogg, Jr., Prof. of Botany, Univ. of Penna. University of Pennsylvania Press (1945). $2.50.

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